

**EPA Superfund
Record of Decision:**

**HOWE VALLEY LANDFILL
EPA ID: KYD980501191
OU 01
HOWE VALLEY, KY
09/28/1990**

This ROD has an associated ESD.

#SNL

SITE NAME AND LOCATION

HOWE VALLEY LANDFILL SITE
HOWE VALLEY, KENTUCKY

#SBP

STATEMENT OF BASIS AND PURPOSE

THIS DECISION DOCUMENT REPRESENTS THE SELECTED REMEDIAL ACTION FOR THE HOWE VALLEY LANDFILL SITE DEVELOPED IN ACCORDANCE WITH THE COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION AND LIABILITY ACT OF 1980 (CERCLA), AS AMENDED BY THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 (SARA), AND, TO THE EXTENT PRACTICABLE, THE NATIONAL OIL AND HAZARDOUS SUBSTANCES POLLUTION CONTINGENCY PLAN (NCP). THIS DECISION IS BASED UPON THE CONTENTS OF THE ADMINISTRATIVE RECORD FOR THE HOWE VALLEY LANDFILL SITE.

AT THIS TIME, THE COMMONWEALTH OF KENTUCKY AGREES WITH THE SELECTED REMEDY, BUT WITH RESERVATIONS. THE COMMONWEALTH ALSO BELIEVES THAT KRS 224.877 IS NOT ADDRESSED IN THIS RECORD OF DECISION. ALTHOUGH NOT AGREEING WITH THE COMMONWEALTH'S CONTENTION, EPA HAS CAREFULLY CONSIDERED THE RISKS ASSOCIATED WITH THE ON-SITE CONTAMINATION AND FEELS THAT BOTH THE PRIMARY AND THE CONTINGENCY ALTERNATIVES WILL BE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT AT A REASONABLE COST.

#AS

ASSESSMENT OF THE SITE

ACTUAL OR THREATENED RELEASES OF HAZARDOUS SUBSTANCES FROM THIS SITE, IF NOT ADDRESSED BY IMPLEMENTING THE RESPONSE ACTION SELECTED IN THIS RECORD OF DECISION (ROD), MAY PRESENT AN IMMINENT AND SUBSTANTIAL ENDANGERMENT TO PUBLIC HEALTH, WELFARE, OR THE ENVIRONMENT.

#SD

STATUTORY DETERMINATIONS

THE SELECTED PRIMARY AND CONTINGENCY REMEDIES ARE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT, COMPLY WITH ALL REQUIREMENTS THAT ARE LEGALLY APPLICABLE OR RELEVANT AND APPROPRIATE TO THE REMEDIAL ACTION, AND ARE COST-EFFECTIVE. THESE REMEDIES UTILIZE PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE, AND SATISFY THE STATUTORY PREFERENCE FOR REMEDIES THAT EMPLOY TREATMENT THAT REDUCES TOXICITY, MOBILITY, OR VOLUME AS A PRINCIPAL ELEMENT.

THE KARST TOPOGRAPHY ASSOCIATED WITH THE HOWE VALLEY LANDFILL SITE MAKES INSTALLATION OF WELLS TO MONITOR GROUNDWATER VIRTUALLY IMPOSSIBLE. CONFIRMATION THAT A WELL INTERCEPTS A GROUNDWATER CONDUIT WOULD REQUIRE NUMEROUS DYE-TRACE STUDIES. DUE TO THIS FACT THERE IS A SLIGHT POSSIBILITY THAT GROUNDWATER UNDERLYING THE SITE COULD CONTAIN UNDETECTED CONTAMINATION THAT IS ASSOCIATED WITH THE SITE WHICH, IN TURN, COULD MIGRATE OFF-SITE. TO ENSURE THAT ANY OFF-SITE MIGRATION DOES NOT BECOME A THREAT TO HUMAN HEALTH OR THE ENVIRONMENT, QUARTERLY SAMPLING OF THE WATER AT BOUTWELL SPRING AND ANY OTHER SPRINGS OR WELLS LOCATED ALONG THE GROUNDWATER CONDUIT BETWEEN BOUTWELL SPRING AND THE SITE WILL OCCUR FOR A PERIOD OF FIVE YEARS. AT THE COMPLETION OF THE FIVE YEAR PERIOD, A RISK ASSESSMENT FOR BOTH THE ON-SITE SOILS AND OFF-SITE GROUNDWATER WILL BE CONDUCTED TO ENSURE THAT THE IMPLEMENTED REMEDY CONTINUES TO PROVIDE ADEQUATE PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT.

GREER C. TIDWELL
REGIONAL ADMINISTRATOR

DATE 09/28/90

#SLD

SITE LOCATION AND DESCRIPTION

LOCATION

THE HOWE VALLEY LANDFILL SITE, CONSISTING OF APPROXIMATELY 11 ACRES, IS LOCATED IN HARDIN COUNTY, SOUTH OF VERTREES, KENTUCKY. IT IS 1.4 MILES SOUTH OF STATE ROAD 86 AT THE END OF TOM DUVAL LANE (FIGURE 1). THE SITE LIES ALONG THE BOUNDARY OF THE CONSTANTINE AND HOWE VALLEY UNITED STATES GEOLOGICAL SURVEY (USGS) QUADRANGLE MAPS AT COORDINATES OF 3740'05" N LATITUDE AND 8607'30" W LONGITUDE. THE SITE CONSISTS OF A SPARSELY VEGETATED FIELD LOCATED IN A TOPOGRAPHIC BASIN. BETWEEN 1966 AND 1976, APPROXIMATELY 2.5 ACRES OF THE SITE WERE CLEARED FOR DISPOSAL PURPOSES.

TOPOGRAPHY

THE TOPOGRAPHY OF THE SITE IS CHARACTERIZED BY GENTLY TO MODERATELY ROLLING UPLANDS (ROUGH IN PLACES) WITH LOWER-LYING KARST PLAINS (FIGURE 2). THE AREAS NORTH AND NORTHEAST OF THE SITE ARE KARST PLAINS, CHARACTERIZED BY SINKHOLES, SINKING STREAMS, SPRINGS AND SOLUTION FEATURES. ELEVATION OF THE KARST PLAIN RANGES BETWEEN 640 AND 730 FEET ABOVE SEA LEVEL. TOPOGRAPHY THROUGHOUT THE REST OF THE SITE IS CHARACTERIZED BY RELATIVELY STEEP-SIDED RIDGES AND VALLEYS. THE COW CLIFF FORMS A TOPOGRAPHIC RIDGE ON THE EASTERN AND SOUTHERN BORDERS OF THE SITE. APPROXIMATE ELEVATION IN THE HOWE VALLEY AREA RANGES FROM 600 TO 900 FEET ABOVE SEA LEVEL WHILE THE SITE RANGES FROM 600 FEET TO 710 FEET ABOVE SEA LEVEL.

DRAINAGE FROM THE SITE FLOWS EAST INTO THE ON-SITE SINKHOLE; A LARGE DEPRESSION APPROXIMATELY 150 FEET LONG AND 30 FEET WIDE WITH THE LONGER DIMENSION TRENDING NORTHEAST TO SOUTHWEST. SEVERAL SWALLETS, RANGING FROM 10 TO 15 FEET IN DIAMETER AND 5 TO 10 FEET IN DEPTH, HAVE DEVELOPED WITHIN THIS SINKHOLE. DURING PERIODS OF HEAVY SEDIMENTATION, THE DIAMETER OF THE SWALLET OPENINGS HAVE BEEN AS NARROW AS 2 TO 6 INCHES. THE SITE IS LOCATED WITHIN A CLOSED BASIN, THEREFORE NO OFF-SITE SINKHOLES RECEIVE SURFACE RUN-OFF FROM THE SITE.

THE UNDERLYING STRATA OF THE SITE ARE PART OF THE MISSISSIPPIAN PLATEAU; A LARGE BELT OF ALTERNATING BEDS OF SANDSTONE, SHALE AND SOLUBLE CARBONATES EXTENDING NORTHWARD INTO INDIANA, WEST TO MISSOURI AND SOUTH TO TENNESSEE. THE SITE IS SITUATED UPON THE PAOLI LIMESTONE, A LIGHT-GRAY, LEDGE-FORMING LIMESTONE 50 FEET THICK. UNDERLYING THE PAOLI IS THE YELLOWISH GRAY TO LIGHT GRAY STE. GENEVIEVE LIMESTONE. BOTH THE PAOLI AND STE. GENEVIEVE LIMESTONES SERVE AS AQUIFERS. THE FORMATIONS OVERLYING THE PAOLI LIMESTONE IN THE SURROUNDING RIDGES INCLUDE:

HARDINSBURG SANDSTONE	(5+ FEET THICK)
HANEY LIMESTONE MEMBER	(15 FEET THICK)
BIG CLIFTY SANDSTONE MEMBER	(100 FEET THICK)
BEECH CREEK LIMESTONE MEMBER	(15 FEET THICK)
REELSVILLE LIMESTONE	(20 FEET THICK)
SAMPLE SANDSTONE	(30 FEET THICK)
BEAVER BEND LIMESTONE AND	
MOORETOWN FORMATION	(30 FEET THICK)
PAOLI LIMESTONE	(50 FEET THICK)
STE. GENEVIEVE	(170 FEET THICK)

STRATA DIP TO THE SOUTHWEST AT APPROXIMATELY 1 FOOT PER 100 FEET. CONSIDERABLE FAULTING HAS OCCURRED WEST OF THE SITE. THE TWO MAJOR FAULTS IN THAT AREA ARE THE POLE BRIDGE FAULT AND THE MOUNT OLIVE FAULT. BOTH ARE THOUGHT TO BE INACTIVE AND ARE LOCATED ABOUT TWO MILES WEST OF THE SITE. THE FAULT LINES ARE IN A NORTHEAST-SOUTHWEST DIRECTION. MINOR FAULTING HAS OCCURRED TO THE NORTH, NORTHWEST, SOUTHWEST AND SOUTH-SOUTHEAST OF THE SITE. THE CLOSEST MINOR FAULTS ARE

FOUND ONE MILE WEST OF THE SITE AND ARE ORIENTED IN A NORTHEAST-SOUTHWEST DIRECTION.

SOIL

THE SOIL IN THE VICINITY OF THE SITE IS OF THE CANEYVILLE-HAGERSTOWN ASSOCIATION, WHICH IS COMPRISED OF MODERATELY STEEP TO GENTLY SLOPING, WELL DRAINED SOILS AND ROCK OUTCROPS ON HILLY KARST UPLANDS. THE CANEYVILLE SOIL, FOUND ON HILLSIDES, IS WELL DRAINED AND SLOPING TO MODERATELY STEEP. IT HAS A LOAMY PLOW LAYER AND A CLAYEY SUBSOIL THAT IS UNDERLAIN BY LIMESTONE. THE HAGERSTOWN SOIL, FOUND ON RIDGES AND SIDE SLOPES, IS DEEP, WELL DRAINED, AND GENTLY SLOPING TO MODERATELY STEEP. IT HAS A LOAMY PLOW LAYER AND A CLAYEY SUBSOIL.

SURFACE WATER AND SEDIMENTS

SURFACE DRAINAGE IN THE AREA OF THE SITE IS INTERMITTENT AND DRAINAGE DITCHES ARE TRUNCATED BY SINKHOLES. THE SITE ITSELF IS LOCATED IN A CLOSED 450-ACRE HYDROLOGIC BASIN WHICH DRAINS TO THE ON-SITE SINKHOLE. SURFACE DRAINAGE BECOMES MORE DENSE TO THE WEST AND SOUTHWEST OF THE SITE. IN THESE AREAS DENDRITIC STREAM PATTERNS CAN BE FOUND ADJACENT TO THE SANDSTONE CAPPED RIDGES. GROUNDWATER DISCHARGED AT BOUTWELL SPRING MOVES TOWARDS LINDERS CREEK, THE PRIMARY LOCAL BASE-LEVEL IN THE REGION. BOTH BOUTWELL SPRING AND LINDERS CREEK ARE SOUTHWEST OF THE SITE. LINDERS CREEK FLOWS INTO THE ROUGH RIVER WHICH FLOWS TO THE GREEN RIVER AND EVENTUALLY TO THE OHIO RIVER NEAR HENDERSON, KENTUCKY.

KARST WINDOWS, SUCH AS STILES SPRING AND ROARING SPRING, ARE LOCATED NEAR THE SITE. THESE WINDOWS ARE TOPOGRAPHIC DEPRESSIONS IN WHICH GROUNDWATER IS DISCHARGED VIA A SPRING, FLOWS ALONG THE SURFACE FOR A SHORT DISTANCE AND THEN RETURNS TO THE SUBSURFACE THROUGH A SINKHOLE SWALLET OR CAVE OPENING.

ALL SEDIMENTS MIGRATING FROM THE SITE ARE CARRIED BY SURFACE RUNOFF DRAINING INTO THE ON-SITE SINKHOLE. BASED UPON DATA COLLECTED DURING THE DYE-TRACE STUDIES, THESE SEDIMENTS ARE DISCHARGED AT BOUTWELL SPRING AND EVENTUALLY TRAVEL TO LINDERS CREEK. DYE TRACES INDICATE THAT THESE SINKS ARE NOT CONNECTED TO THE SITE.

GROUNDWATER FLOW

SURFACE RUNOFF IN THE KARST PLAIN, WHICH INCLUDES THE SITE, IS INTERCEPTED BY NUMEROUS SINKS. GROUNDWATER CONTINUOUSLY TRIES TO REACH A BASE-LEVEL BY MOVING THROUGH DISCONTINUOUS JOINTS AND CAVITIES THAT CHARACTERIZE A KARST SYSTEM. LINDERS CREEK REPRESENTS THE PRIMARY BASE LEVEL TOWARD WHICH GROUNDWATER BELOW THE SITE MOVES TOWARDS. DYE TRACE STUDIES WERE CONDUCTED AT THE SITE AND NORTH OF THE SITE BY THE PRP'S CONTRACTOR AND THE USGS, RESPECTIVELY. RESULTS INDICATED THAT WATER LEAVING THE SITE BY WAY OF THE ON-SITE SINKHOLE, TRAVELED SOUTHWEST TOWARDS BOUTWELL SPRING AND LINDERS CREEK. THE USGS DYE TRACE STUDY INDICATES THE PRESENCE OF A GROUNDWATER DIVIDE TO THE NORTH OF THE SITE, BETWEEN PIRTLE SPRING AND THE HOWE VALLEY LANDFILL. PIRTLE SPRING SERVES AS THE DRINKING WATER SUPPLY FOR THE HOWE VALLEY AREA. THIS GROUNDWATER BOUNDARY IMPLIES THAT GROUNDWATER FLOWING FROM THE SITE TRAVELS ON THE OPPOSITE SIDE OF THE DIVIDE, AWAY FROM PIRTLE SPRING; THUS, A NATURAL BARRIER PREVENTS THE POSSIBILITY OF GROUNDWATER FROM THE SITE CONTAMINATING THE PUBLIC DRINKING WATER SUPPLY.

LAND USAGE

MUCH OF HARDIN COUNTY IS FARMLAND AND PASTURES USED PRIMARILY FOR THE PRODUCTION OF CORN, SOYBEANS, HAY AND TOBACCO. THERE ARE NO KNOWN INDUSTRIAL FACILITIES LOCATED NEAR THE SITE. THE LAND IMMEDIATELY ADJACENT TO THE SITE CONSISTS OF HILLY WOODLANDS. ACCORDING TO NEARBY RESIDENTS, THESE WOODS ARE POPULAR FOR HUNTERS STALKING DEER, RABBITS, AND RACCOON. THERE ARE 13 INHABITED HOUSES, APPROXIMATELY 50 RESIDENTS, ALONG THE 1.4 MILE LENGTH OF TOM DUVAL LANE.

THE NEAREST STRUCTURE IS A 250-ACRE FARM LOCATED APPROXIMATELY 800 FEET NORTH OF THE SITE. THE FARM IS A CATTLE AND HOG RAISING OPERATION THAT GROWS CORN AND SOYBEANS AS FEED FOR THE LIVESTOCK. THE NEAREST OCCUPIED RESIDENCE, TWO RESIDENTS, IS LOCATED 2,000 FEET NORTH OF THE SITE AT THE TERMINUS OF TOM DUVALL LANE. THE NEAREST RESIDENCE NOT ON TOM DUVALL LANE LIES ONE MILE WEST OF THE SITE.

DEMOGRAPHY

THE SITE IS NAMED FOR THE UNINCORPORATED COMMUNITY OF HOWE VALLEY LOCATED APPROXIMATELY TWO MILES NORTHEAST OF THE LANDFILL. HOWE VALLEY PROPER, MADE UP OF APPROXIMATELY 700 RESIDENTS, CENTERS AROUND THE INTERSECTION OF HOWE VALLEY ROAD AND HARDINSBURG ROAD (STATE HIGHWAY 86). THE SITE ALSO LIES IN CENSUS DISTRICT 171 (FIGURE 3). THE TOTAL POPULATION OF THIS DISTRICT IS 1,890. ELIZABETHTOWN, A CITY OF APPROXIMATELY 16,000 PEOPLE AND THE COUNTY SEAT, IS LOCATED FIFTEEN MILES EAST OF HOWE VALLEY. THIS CITY IS THE NEAREST URBAN CENTER.

GROUNDWATER RESOURCES

PIRTLE SPRING, LOCATED NEAR VERTREES, KENTUCKY, TAPS THE ST. GENEVIEVE AQUIFER. THIS SPRING IS THE PUBLIC WATER SUPPLY FOR APPROXIMATELY 35,000 RESIDENTS IN THE SURROUNDING AREA, HOWEVER MANY RESIDENTS IN THE VICINITY OF THE SITE USE PRIVATE WELLS AS THEIR DRINKING WATER SOURCE.

NATURAL RESOURCES

NO NATIONAL PARKS, NATIONAL WILDLIFE REFUGES, INDIAN RESERVATIONS OR WETLANDS OCCUR IN THE IMMEDIATE VICINITY OF THE SITE. THE PRIMARY HABITAT OBSERVED AROUND THE SITE CONSISTS OF MIXED HARDWOODS AND PINES. MAJOR TREE SPECIES IN THE HOWE VALLEY AREA ARE BLACK OAK, RED OAK, POPLAR, YELLOW PINE AND CEDAR. THE SITE, WHICH WAS CLEARED DURING DISPOSAL ACTIVITIES, IS SPARSELY VEGETATED AND HAS ONLY TWO MAJOR TREE SPECIES; SECOND-GROWTH CEDAR AND SCOTCH PINE. THE PINE TREES WERE PLANTED BY THE LANDFILL OPERATOR SOMETIME DURING THE DISPOSAL OPERATIONS.

TWO STATE AND FEDERALLY LISTED ENDANGERED SPECIES ARE PRESENT IN HARDIN COUNTY: THE GRAY BAT (MYOTIS GRISESCENS) AND THE INDIANA BAT (MYOTIS SODALIS). THE NEAREST SITING OF THE GRAY BAT WAS RECORDED AT BELT CAVE, THREE MILES NORTH OF THE SITE. NO THREATENED SPECIES OCCUR IN HARDIN COUNTY, HOWEVER THE HENSLOW SPARROW HAS BEEN LISTED AS A SPECIAL CONCERN BY THE KENTUCKY DEPARTMENT OF FISH AND WILDLIFE. NO FISH SPECIES OCCUR ON-SITE. FROGS AND SNAPPING TURTLES WERE OBSERVED IN THE ON-SITE PONDS, HOWEVER, THESE PONDS WERE REMOVED DURING THE RI/FS. OTHER WILDLIFE SPECIES OBSERVED ON-SITE INCLUDE: BOX TURTLES, LIZARDS, BLACK SNAKES, COPPERHEAD SNAKES, DEER, RACCOONS, OPOSSUM, RABBITS, SQUIRRELS, FIELD MICE, VULTURES, CROWS, RED-TAIL HAWKS, SCREECH OWLS, ROUGH GROUSE AND SEVERAL SPECIES OF SMALLER BIRDS.

#SHEA

SITE HISTORY AND ENFORCEMENT ACTIVITIES

DISPOSAL OPERATIONS

KENTUCKY INDUSTRIAL SERVICES, INC. (KIS) OPERATED THE HOWE VALLEY LANDFILL SITE FROM 1967 TO 1976 FOR THE DISPOSAL OF REFUSE AND MANUFACTURING BY-PRODUCTS FROM SEVERAL ELIZABETHTOWN INDUSTRIES. TO COMPLY WITH NEW LEGISLATION PASSED IN 1972 BY THE COMMONWEALTH OF KENTUCKY, KIS APPLIED FOR AND RECEIVED A SOLID WASTE PERMIT TO OPERATE THE SITE AS AN INDUSTRIAL LANDFILL. TYPES OF WASTE REPORTEDLY DISPOSED AT THE SITE CONSISTED OF MANUFACTURING SLUDGES, PLATING SLUDGES, GALVANIZING WASTES, SILICONE POLYMERS, INSULATION AND INSULATION BY-PRODUCTS. FIGURE 4 DEPICTS THE AREAS USED FOR DISPOSAL.

EARLY INVESTIGATIONS

IN MAY 1974, AFTER A CITIZEN COMPLAINT, THE STATE DIVISION OF WASTE MANAGEMENT CONDUCTED A SITE INSPECTION. THE INSPECTION REPORT STATED THAT ACIDIC LIQUID WASTES WERE BEING DUMPED DIRECTLY INTO THE LANDFILL. THIS CONSTITUTED A VIOLATION SINCE THE STATE-ISSUED SOLID WASTE PERMIT DID NOT ALLOW THE DISPOSAL OF LIQUID WASTES AT THE SITE. AT THAT TIME THE PERMIT DID NOT DIFFERENTIATE BETWEEN HAZARDOUS AND NON-HAZARDOUS WASTES. THE PERMIT OFFICIALLY EXPIRED IN 1974, HOWEVER THE LANDFILL WAS NOT CLOSED UNTIL 1976. FROM THAT TIME UNTIL THE REMEDIAL INVESTIGATION BEGAN, ACCESS TO THE SITE WAS LIMITED BUT NOT RESTRICTED.

A SECOND SITE INSPECTION CONDUCTED BY THE STATE DIVISION OF WASTE MANAGEMENT IN 1979 REVEALED THAT WASTES FROM THE SITE WERE KILLING ON-SITE VEGETATION AND PRODUCING A FOUL ODOR. THE REPORT ALSO DOCUMENTED THE DEATH OF THREE PONIES THAT GRAZED DOWNSLOPE FROM THE SITE. AUTOPSIES OF THE PONIES REVEALED LIVER ABNORMALITIES. THESE CIRCUMSTANCES AND THE EXISTING KARST CONDITIONS PROMPTED THE STATE TO BEGIN INVESTIGATING THE SITE AND SURROUNDING AREAS. ACTIVITIES INCLUDED A DYE-TRACE STUDY TO DETERMINE THE DIRECTION OF GROUNDWATER FLOW AND SURFACE WATER FLOW UNDERNEATH AND AWAY FROM THE SITE, OFF-SITE SAMPLING OF NEARBY WATER SOURCES TO DETERMINE THE EXTENT OF CONTAMINATION AND ON-SITE SAMPLING OF THE SOILS AND SURFACE WATERS TO IDENTIFY WASTE COMPONENTS. SAMPLING RESULTS SUGGESTED THAT CONTAMINANTS FROM THE LANDFILL COULD POTENTIALLY MIGRATE TO LINDERS CREEK AND INFILTRATE THE GREEN RIVER DRAINAGE BASIN. TRAVEL TIME OF THE GROUNDWATER, AS DETERMINED BY THE DYE-TRACE STUDY, WAS APPROXIMATELY 1,400 FEET PER DAY (1 FOOT PER MINUTE).

UPON REQUEST BY THE STATE, THE US ENVIRONMENTAL PROTECTION AGENCY'S FIELD INVESTIGATION TEAM (FIT), IN 1984, COMPLETED A PRELIMINARY ASSESSMENT AND A SITE INVESTIGATION. AS PART OF THESE STUDIES, A GEOPHYSICAL INVESTIGATION WAS CONDUCTED TO DETERMINE THE DOWN-GRADIENT LOCATION OF THE SOLUTION CHANNEL AND TO INVESTIGATE THE AERIAL EXTENT OF DRUM BURIAL. AS PART OF THE ATTEMPT TO LOCATE THE SOLUTION CHANNEL, AN ELECTROMAGNETIC SURVEY AND A DIPOLE-DIPOLE RESISTIVITY SURVEY WERE CONDUCTED. INTERFERENCE FROM THE MATERIALS BURIED AT THE LANDFILL AND OFF-SITE TOPOGRAPHY PREVENTED THE IDENTIFICATION OF SOLUTION FEATURES, HOWEVER THE RESISTIVITY SURVEY DID INDICATE AN ANOMALY SOUTHWEST OF THE SITE. UNFORTUNATELY, IT WAS NOT POSITIVELY IDENTIFIED AS A SOLUTION CHANNEL AND NO ADDITIONAL ATTEMPT WAS MADE TO FURTHER DELINEATE OR IDENTIFY THE ANOMALY. A MAGNETICS SURVEY WAS CONDUCTED TO IDENTIFY THE DRUM BURIAL AREAS. RESULTS INDICATED THAT BETWEEN 2,000 TO 5,000 DRUMS WERE BURIED IN LOCALIZED POCKETS IN ONLY 2.5 ACRES OF THE SITE.

SINCE THE HOWE VALLEY LANDFILL HAD THE POTENTIAL TO CONTAMINATE THE UNDERLYING KARST GROUNDWATER SYSTEM, THE SITE WAS ASSIGNED A HAZARD RANKING SCORE (HRS) OF 36.73. ON JUNE 10, 1986, (51 FEDERAL REGISTER 21106), THE US EPA PROPOSED THAT THE HOWE VALLEY LANDFILL SITE BE INCLUDED ON THE NATIONAL PRIORITIES LIST (NPL). THE LISTING OF THE SITE BECAME FINAL ON JULY 22, 1987, (51 FEDERAL REGISTER 27623).

IN SEPTEMBER 1987, THE US EPA COLLECTED A SUBSURFACE SOIL SAMPLE FROM BENEATH A PARTIALLY BURIED DRUM AND A SEDIMENT SAMPLE FROM AN ON-SITE POND. SUBSTANCES DETECTED DURING ANALYSIS OF THE SOIL SAMPLE INCLUDED CYANIDE AND ONE ORGANIC COMPOUND. THE SEDIMENT SAMPLE CONTAINED A TRACE AMOUNT OF CYANIDE AND THREE PHTHALATE COMPOUNDS. DURING THIS SAME TIME, WATER SAMPLES WERE COLLECTED FROM PIRTLE SPRING, HOWE VALLEY ELEMENTARY SCHOOL AND FIVE PRIVATE WELLS IN THE AREA. ONE WELL (WOODROW STEVENS) INITIALLY TESTED HIGH FOR LEAD AND CHROMIUM, HOWEVER IN A SUBSEQUENT SAMPLING BOTH METALS WERE BELOW DETECTION LIMITS.

THE POTENTIALLY RESPONSIBLE PARTIES (PRPS) FOR THE CONTAMINATION AT THE HOWE VALLEY LANDFILL SITE WERE NOTIFIED IN WRITING OF THEIR POSSIBLE LIABILITY VIA A NOTICE LETTER FROM THE US EPA DATED SEPTEMBER 4, 1987. THE LETTER ALSO GAVE THE PRPS THE OPPORTUNITY TO CONDUCT THE REMOVAL, THE REMEDIAL INVESTIGATION (RI) AND THE FEASIBILITY STUDY (FS) UNDER US EPA'S SUPERVISION. ONLY TWO OF THE NINE IDENTIFIED PRPS AGREED TO UNDERTAKE BOTH THE REMOVAL AND THE RI/FS. AN ADMINISTRATIVE ORDER ON CONSENT BETWEEN THE US EPA AND TWO PRPS WAS SIGNED AND PUT INTO EFFECT

ON APRIL 15, 1988. WORK ON THESE ACTIVITIES WAS CONDUCTED BY THE PRPS CONTRACTOR BEGINNING IN MAY 1988 AND CONCLUDING IN MAY 1990.

REMOVAL ACTIVITIES

BASED UPON THE NUMBER OF DRUMS THAT WERE BURIED ON SITE AND THE POSSIBILITY THAT THESE DRUMS CONTAINED HAZARDOUS WASTES THAT WERE ESCAPING INTO THE ENVIRONMENT, THE US EPA FELT THAT AN IMMEDIATE REMOVAL WAS NECESSARY TO REDUCE ANY IMMINENT AND SUBSTANTIAL DANGER TO HUMAN HEALTH AND THE SURROUNDING ENVIRONMENT. REMOVAL ACTIVITIES WERE CONDUCTED BY THE PRPS CONTRACTOR BEGINNING ON JUNE 7, 1988. THE PROGRESSION OF EXCAVATION ACTIVITIES IS SHOWN IN FIGURE 5.

DRUMS WERE UNCOVERED AND TRANSPORTED TO A STAGING AREA WHERE EACH WAS RECORDED IN A DRUM LOG AND THE CONTENTS SAMPLED. RUN-ON WATER ENTERING THE SITE WAS DIVERTED TO A DITCH CONSTRUCTED AROUND THE PERIMETER OF THE SITE AND CAPTURED IN AN ON-SITE HOLDING POND. THIS PREVENTED THE ESCAPE OF EXPOSED MATERIALS AND CONTAMINANTS FROM THE SITE BY WAY OF THE ON-SITE SINKHOLE. FIGURE 6 SHOWS THE LOCATION OF STAGING AREAS AND DIVERSION DITCHES. EXCAVATION CONTINUED UNTIL SEPTEMBER 9, 1988 WHEN THE LAST DRUM WAS REMOVED.

IN TOTAL, 9,150 FULL OR PARTIALLY FILLED DRUMS, 1,621 EMPTY DRUMS, 6,000 SMALLER DRUMS AND 3,000 CUBIC YARDS OF NON-CONTAINERIZED WASTES WERE REMOVED FROM THE SITE. APPROXIMATELY 10,000 GALLONS OF RUNOFF WATER COLLECTED IN THE HOLDING POND WERE TREATED ON-SITE WITH A TWO-STAGE MIXED MEDIA AND ACTIVATED CARBON FILTRATION UNIT. AFTER THE FILTERED WATER WAS ANALYZED AND DETERMINED TO BE CLEAN, IT WAS USED FOR DUST SUPPRESSION AND EQUIPMENT CLEANING.

DRUMS AT THE SITE WERE FOUND BURIED IN PRIMARILY TWO DIFFERENT FASHIONS. DRUMS IN THE CENTRAL AREA OF THE SITE WERE HAPHAZARDLY ORIENTED, SOMETIMES CRUSHED AND WITHOUT LIDS. THREE TO FOUR LAYERS OF DRUMS MIXED WITH NON-CONTAINERIZED WASTE AND SOIL WERE BURIED TO DEPTHS OF EIGHT OR TWELVE FEET. SOIL IN THIS AREA WAS TYPICALLY DRY WITH THE EXCEPTION OF A FEW LOCALIZED ZONES OF PERCHED WATER AROUND THE WASTES. SEVERAL THOUSAND SMALL CONTAINERS, PINT SIZE TO 5-GALLON SIZE, WERE UNCOVERED ALONG WITH THE DRUMS. THESE SMALLER CONTAINERS WERE FILLED WITH THE SAME TYPES OF SILICONE POLYMERS FOUND IN THE LARGER DRUMS.

IN OUTLYING AREAS SURROUNDING THE CENTRAL AREA, DRUMS WERE BURIED UPRIGHT IN TIGHTLY PACKED GROUPS. IN SOME LOCATIONS DRUMS WERE STACKED ON ROTTING WOODEN PALLETS LOCATED DIRECTLY ON TOP OF BEDROCK. THE MAJORITY OF DRUMS HAD LIDS AND SHOWED ONLY MINIMAL TRACES OF DAMAGE OR RUST. EXCAVATIONS WERE GENERALLY DEVOID OF FREE LIQUIDS AND RANGED FROM FOUR TO EIGHT FEET IN DEPTH.

THE FOLLOWING TYPES OF WASTES WERE BELIEVED TO BE ON-SITE PRIOR TO THE REMOVAL:

- CONTAINERIZED WASTES PLACED ABOVE GROUND AND COVERED WITH SOIL OR PLACED BELOW GROUND IN TRENCHES. INCLUDED:
 - HEAVY METAL (BLUE-GRAY) PLATING SLUDGES
 - SILICONE POLYMER WASTES
 - ORGANIC LIQUIDS ASSOCIATED WITH SILICONE POLYMER WASTES
 - INSULATION MANUFACTURING CHEMICALS
 - NON-HAZARDOUS REFUSE
 - NON-CONTAINERIZED, LIQUID "OILY WASTE BY-PRODUCT" PLACED IN A TRENCH
 - NON-CONTAINERIZED, SILICONE POLYMERS BURIED IN TRENCHES
 - PILES OF INSULATION AND INDUSTRIAL/DOMESTIC TRASH PLACED ABOVE GROUND

THE VARIOUS WASTES THAT WERE ACTUALLY FOUND ARE BRIEFLY DISCUSSED IN THE FOLLOWING PARAGRAPHS. FIGURE 4 SHOWS THE EXTENT OF EACH WASTE PRIOR TO REMOVAL. BOTH THE COMPOSITION OF THE WASTE AND THE METHODS OF FINAL DISPOSAL ARE PRESENTED. DETAILED DESCRIPTIONS OF SITE ACTIVITIES AND DISPOSAL RECORDS ARE CONTAINED IN THE JULY 1990 REMEDIAL INVESTIGATION REPORT AND THE REMOVAL

MONTHLY PROGRESS REPORTS LOCATED IN THE ADMINISTRATIVE RECORD. A COPY OF THE ADMINISTRATIVE RECORD IS KEPT IN THE HARDIN COUNTY PUBLIC LIBRARY IN ELIZABETHTOWN, KENTUCKY AND IN THE US EPA'S REGION IV OFFICE IN ATLANTA, GEORGIA.

A. BLUE-GRAY PLATING SLUDGE

THE BLUE-GRAY PLATING SLUDGE WAS CHARACTERIZED AS A SOLID TO SEMI-SOLID MATERIAL. THREE COMPOSITE SAMPLES OF THE SLUDGE WERE COLLECTED FROM 75 DRUMS (25 DRUMS PER COMPOSITE) AND ANALYZED IN AN OFF-SITE LABORATORY. THE RESULTS ARE COMPILED IN TABLE 1. THE PLATING SLUDGES WERE CONSOLIDATED AND THEN SENT TO THE CHEMICAL WASTE MANAGEMENT LANDFILL NEAR FT. WAYNE, INDIANA AND THE CHEMICAL WASTE MANAGEMENT LANDFILL IN EMELLE, ALABAMA.

B. SOLID SILICONE

A TOTAL OF 4,151 DRUMS WERE FOUND TO CONTAIN SILICONE POLYMERS IN VARIOUS STAGES OF CURING. ON-SITE ANALYSIS CLASSIFIED THE POLYMERS AS FLAMMABLE SOLIDS WITH A FLASH POINT BELOW 140F; SOLUBLE IN HEXANE AND INSOLUBLE IN WATER. RESULTS OF THE OFF-SITE LABORATORY ANALYSIS ARE PRESENTED IN TABLE 2.

INITIALLY, TWO TRACTOR TRAILER LOADS OF DRUMS WERE OVERPACKED AND SENT FOR TRIAL BURNS TO THE THERMAL KEM INCINERATOR IN ROCK HILL, SOUTH CAROLINA AND THE ROLLINS ENVIRONMENTAL SERVICES INCINERATOR IN DEER PARK, TEXAS. FROM THE TEST BURN RESULTS, THE ROLLINS FACILITY WAS SELECTED TO RECEIVE THE SOLID SILICONE WASTE SHIPMENTS, HOWEVER THE PRPS SUBSEQUENTLY SENT APPROXIMATELY ONE-HALF OF THE SOLID SILICONE TO THE CHEMICAL WASTE MANAGEMENT LANDFILL IN EMELLE, ALABAMA, WITH EPA'S APPROVAL, DUE TO HIGH INCINERATION COSTS.

C. SEMI-SOLID SILICONE

A TOTAL OF 513 DRUMS CONTAINED SEMI-SOLID WASTES SUCH AS PARTIALLY CURED CAULK, GEL-LIKE SILICONE POLYMERS AND THICK PAINT-LIKE PIGMENTS. A COMPOSITE WAS COLLECTED FROM SEVERAL DRUMS AND SENT OFF-SITE FOR ANALYSIS. RESULTS ARE PRESENTED IN TABLE 3. DRUMS CONTAINING THE SEMI-SOLID SILICONE WERE OVERPACKED AND SENT TO THERMAL KEM AND ROLLINS FOR INCINERATION AND PETRO-CHEM PROCESSING, INC., IN DETROIT, MICHIGAN, FOR FUEL BLENDING INCINERATION.

D. LIQUIDS

LIQUIDS ASSOCIATED WITH THE MANUFACTURING OF SILICONE POLYMERS WERE FOUND IN A TOTAL OF 1,541 DRUMS. A COMPOSITE SAMPLE WAS ANALYZED IN AN OFF-SITE LABORATORY. TABLE 4 SUMMARIZES THE ANALYTICAL RESULTS. OVERPACKED DRUMS CONTAINING LIQUID WASTES WERE SENT TO PETRO-CHEM PROCESSING, INC. FOR FUEL BLENDING INCINERATION.

E. INSULATION MANUFACTURING CHEMICALS

A TOTAL OF 138 DRUMS, LOCATED IN THE NORTHEASTERN AREA OF THE SITE, CONTAINED SOLIDS, GELS AND LIQUIDS ASSOCIATED WITH THE MANUFACTURING OF INSULATION. THE SOLID MATERIAL WAS IDENTIFIED AS A FORM OF POLYOL WHILE THE LIQUIDS AND GELS WERE IDENTIFIED AS POLYOL AND POLYMERIC DIISOCYANATE, RESPECTIVELY. THE MANUFACTURING COMPANY PROVIDED DETAILED INFORMATION REGARDING THE DRUMMED MATERIALS, THEREFORE OFF-SITE ANALYSIS WAS NOT CONDUCTED. ALL 138 DRUMS WERE SENT TO PETRO-CHEM PROCESSING, INC. IN DETROIT, MICHIGAN.

F. COPPER-CYANIDE BEARING SLUDGE

A BLUE-BLACK SLUDGE WAS FOUND IN 31 DRUMS LOCATED IN THE NORTHEASTERN AREA OF THE SITE. THE MATERIAL WAS IDENTIFIED AS AN UNLAYERED SOLID, INSOLUBLE IN HEXANE, SOLUBLE IN WATER AND HAVING

A FLASH POINT ABOVE 140 FAHRENHEIT. OFF-SITE ANALYTICAL RESULTS USING US EPA'S TOXIC CHARACTERISTIC LEACHATE PROCEDURE ARE LISTED IN TABLE 5. THE SLUDGE WAS BULKED AND SENT TO THE CHEMICAL WASTE MANAGEMENT LANDFILL IN EMELLE, ALABAMA.

G. OILY WASTE TRENCH

NEARBY RESIDENTS REPORTED THAT THE LANDFILL OPERATOR EXCAVATED A TRENCH IN THE WESTERN SIDE OF THE CENTRAL DISPOSAL AREA AND PLACED IN IT AT LEAST ONE TRUCK LOAD OF A LIQUID OILY WASTE. A COMPOSITE SOIL SAMPLE (FROM TWO, THREE, FOUR, AND FIVE FEET BELOW THE GROUND SURFACE) WAS COLLECTED AT EACH END OF THE IDENTIFIED TRENCH. BOTH SAMPLES WERE ANALYZED OFF-SITE. RESULTS ARE PRESENTED IN TABLE 6. THE FINAL CONCLUSION WAS THAT IF OIL DUMPING HAD OCCURRED, IT DID NOT RESULT IN DETECTABLE CONTAMINATION OF THE SOIL.

H. NON-CONTAINERIZED SILICONE POLYMERS

DURING THE EARLY PHASES OF THE LANDFILL OPERATION, NON-CONTAINERIZED SILICONE POLYMERS WERE PLACED IN TRENCHES PARTIALLY FILLED WITH ACCUMULATED RAINWATER.

THE RESULT WAS A MARSHMALLOW-LIKE MIXTURE OF CURED TO SEMI-CURED SILICONE, SOIL AND SMALL CONTAINERS. FIGURE 7 SHOWS THE AREA OF DISPOSAL TRENCHES.

AN OPENING WAS EXCAVATED IN A TRENCH TO ALLOW COLLECTION OF A COMPOSITE SAMPLE OF THE SILICONE MATERIAL. THE COMPOSITE WAS TAKEN FROM FOUR LOCATIONS TO A DEPTH OF ONE FOOT. THE SAMPLE WAS THEN SENT OFF-SITE FOR ANALYSIS. THE RESULTS ARE PRESENTED IN TABLE 7. APPROXIMATELY 3,000 CUBIC YARDS OF THE SILICONE MATERIAL AND ASSOCIATED SOIL WERE REMOVED FROM THE SITE AND DISPOSED OF IN THE CHEMICAL WASTE MANAGEMENT LANDFILL IN EMELLE, ALABAMA.

I. DOMESTIC TRASH AND INSULATION PILE

A TOTAL OF 1,918 DRUMS, THE MAJORITY WITHOUT LIDS, WERE FOUND TO CONTAIN RAGS, PAPER, PAINT CANS, EMPTY PLASTIC BOTTLES, TEST SAMPLES AND MISCELLANEOUS DEBRIS. IT APPEARED THAT THE DRUMS WERE SENT TO THE LANDFILL ALONG WITH INDUSTRIAL WASTE DRUMS. DUE TO THE NATURE OF THEIR CONTENT, THESE DRUMS WERE NOT ANALYZED. INITIALLY, THE DRUMS WERE OVERPACKED AND SENT TO ROLLINS ENVIRONMENTAL SERVICES IN DEER PARK, TEXAS FOR INCINERATION, HOWEVER IN AN EFFORT TO BE MORE COST-EFFICIENT, THE DRUMS WERE LATER SENT TO THE CHEMICAL WASTE MANAGEMENT LANDFILL IN EMELLE, ALABAMA.

SEVERAL NON-HAZARDOUS, SURFACE PILES OF DOMESTIC REFUSE WERE LOCATED IN THE CENTRAL AREA OF THE SITE. EACH PILE WAS LOADED INTO A DUMP TRUCK AND SENT TO THE HARDIN COUNTY LANDFILL NEAR ELIZABETHTOWN, KENTUCKY. APPROXIMATELY SEVEN LOADS WERE TAKEN TO THE LANDFILL.

IN ADDITION TO DOMESTIC REFUSE, ONE LARGE PILE AND TWO SMALLER PILES OF INSULATION WERE FOUND ABOVE GROUND IN THE CENTRAL AREA OF THE SITE. THREE COMPOSITE SAMPLES WERE TAKEN FROM THE PILE AND SENT OFF-SITE FOR ANALYSIS. RESULTS ARE PRESENTED IN TABLE 8. THE CORPORATION RESPONSIBLE FOR THE DISPOSAL OF THE INSULATION ARRANGED TO HAVE THE PILES SENT TO THE HARDIN COUNTY LANDFILL NEAR ELIZABETHTOWN, KENTUCKY.

POST REMOVAL INVESTIGATIONS

DYE-TRACE STUDIES

1. LOW FLOW CONDITIONS: IN SEPTEMBER 1988 AFTER A SIGNIFICANT DRY PERIOD, A DYE TRACE STUDY WAS CONDUCTED TO IDENTIFY POINTS OF GROUNDWATER DISCHARGE SUITABLE FOR MONITORING AND EVALUATING THE FATE OF WATER ENTERING THE ON-SITE SINKHOLE. AS PART OF THE STUDY SODIUM FLUORESCIEIN DYE WAS

WASHED INTO THE SINKHOLE WITH APPROXIMATELY 3,750 GALLONS OF WATER FOR 15-MINUTES. TWENTY-EIGHT MONITORING POINTS, SUCH AS SPRINGS, WELLS, AND STREAMS, WERE BUGGED WITH ACTIVATED CHARCOAL PACKETS. BUGGED LOCATIONS ARE MARKED IN THIRTY-FOUR DAYS AFTER INJECTION, DYE WAS DETECTED IN BOUTWELL SPRING WHICH FORMS THE HEADWATERS OF THE EASTERN BRANCH OF LINDERS CREEK. TRACES OF DYE WERE ALSO DETECTED IN THE THREE BUGS PLACED DOWNSTREAM IN LINDERS CREEK. BOUTWELL SPRING LIES APPROXIMATELY 1.85 MILES SOUTH OF THE SITE. DISCHARGE RATES AT THE SPRING VARIED FROM 526 TO 1,110 GALLONS PER MINUTE. GROUNDWATER MOVEMENT DURING THE DYE TRACE WAS ESTIMATED TO BE 290 FEET PER DAY (0.2 FEET PER MINUTE).

2. HIGH FLOW CONDITIONS: AN ADDITIONAL DYE TRACE STUDY WAS CONDUCTED IN FEBRUARY 1990. THE GOAL OF THE SECOND STUDY WAS TO LOCATE ANY GROUNDWATER RESURGENCES THAT WERE NOT APPARENT DURING THE LOW FLOW DYE TRACE CONDUCTED IN SEPTEMBER 1988. AGAIN, FLOURESCEIN DYE WAS INJECTED INTO THE ON-SITE SINKHOLE AND FLUSHED WITH 2,000 GALLONS OF WATER FOR 15 MINUTES. A TOTAL OF 31 LOCATIONS WERE BUGGED WITH POUCHES CONTAINING ACTIVATED COCONUT CHARCOAL MONITORING OF BUGGED LOCATIONS CONTINUED UNTIL MARCH 1990. DURING THE MONITORING PERIOD, DYE WAS DETECTED IN ONLY ONE LOCATION, BOUTWELL SPRING. THE ACTUAL HIT OCCURRED WITHIN 24 HOURS AFTER INJECTION. GROUNDWATER FLOW DURING THE SECOND TRACE WAS APPROXIMATELY 10,080 FEET PER DAY (7 FEET PER MINUTE).

ENVIRONMENTAL SAMPLING

THE FOLLOWING SECTION BRIEFLY DISCUSSES THE FIELD SAMPLING ACTIVITIES CONDUCTED BY THE PRPS CONTRACTOR IN 1988 DURING AND AFTER THE REMOVAL. ADDITIONAL SAMPLING WAS CONDUCTED IN MARCH 1990 TO ASSESS ENVIRONMENTAL CONDITIONS AFTER THE REMOVAL AND SOIL AERATION PROJECT. A DETAILED DISCUSSION OF THE 1990 SAMPLING IS PRESENTED LATER IN THE SITE CHARACTERISTICS SECTION. ANALYTICAL RESULTS FOR THE 1988 SAMPLING ARE CONTAINED IN THE JULY 1990 RI REPORT CONTAINED IN THE ADMINISTRATIVE RECORD.

FIELD INVESTIGATIONS INVOLVING SAMPLING OF ENVIRONMENTAL MEDIA SUCH AS THE AIR, SURFACE WATER AND ASSOCIATED SEDIMENTS, GROUNDWATER AND SOIL, WERE CONDUCTED TO EVALUATE THE NATURE AND EXTENT OF CONTAMINATION RESULTING FROM THE HOWE VALLEY LANDFILL. FIGURE 10 SHOWS PROPOSED AND ACTUAL SAMPLING LOCATIONS. DROUGHT CONDITIONS PROHIBITED COLLECTION OF SEVERAL WATER SAMPLES. THE LARGEST PORTION OF WASTES DISPOSED AT THE SITE WERE SILICONE POLYMERS AND PLATING SLUDGES. THE PRIMARY CHEMICAL CONSTITUENTS OF THESE WASTES WERE AS FOLLOWS:

SILICONE POLYMER WASTES - 1,1,1-TRICHLOROETHANE
- 1,2-DICHLOROETHENE
- 1,1-DICHLOROETHANE
- TETRACHLOROETHENE

PLATING SLUDGES
- ZINC
- CHROMIUM
- COPPER
- CYANIDE

AS A RESULT, THESE COMPOUNDS WERE TARGETED IN SAMPLING AND ANALYTICAL PROGRAMS.

A. AIR MONITORING

BASELINE AIR QUALITY MONITORING WITH A PHOTOIONIZATION DETECTOR CONDUCTED PRIOR TO SITE ACTIVITIES INDICATED A RELATIVE ABSENCE OF DETECTABLE ORGANIC VAPORS AT THE SITE. REGULAR AIR QUALITY MONITORING WAS CONDUCTED DURING REMOVAL ACTIVITIES. DOWNWIND AMBIENT AIR MONITORING CONDUCTED WITH AN ORGANIC VAPOR ANALYZER AT THE SITE BOUNDARIES DURING EXCAVATION RANGED FROM BACKGROUND TO ABOUT 5 PARTS PER MILLION (PPM) FOR ORGANIC CONTAMINANT CONCENTRATIONS. ORGANIC

VAPOR CONCENTRATIONS MEASURED WITH A PHOTOIONIZATION DETECTOR DURING CENTRAL AREA SOIL SAMPLING IN THE FALL OF 1988 RANGED FROM 22 TO 450 PPM.

B. SURFACE WATER

1. OFF-SITE SURFACE WATER: DURING THE REMOVAL ACTIVITIES, SAMPLES WERE COLLECTED FROM TWO LOCATIONS IN LINDERS CREEK (LCW1 AND LCW2, SEE FIGURE 11). BOTH LOCATIONS WERE DOWN STREAM FROM BOUTWELL SPRING. THE SAMPLES WERE ANALYZED FOR VOLATILE ORGANIC, METALS AND CYANIDE. TOLUENE, THE ONLY ORGANIC FOUND, WAS DETECTED IN ONE OF THE SAMPLES AT 0.007 MILLIGRAMS PER LITER (MG/L). ADDITIONAL SAMPLES COLLECTED SEVERAL MONTHS LATER DID NOT SHOW THE PRESENCE OF TOLUENE. THIS PARTICULAR IDENTIFICATION, ALTHOUGH NOT A RESULT OF FIELD OR LABORATORY CONTAMINATION, DID NOT APPEAR TO BE RELATED TO THE SITE. IF THE SURFACE WATER CONTAINED CONTAMINATION FROM THE SITE, MORE PREVELANT SITE RELATED CONTAMINANTS WOULD HAVE BEEN DETECTED ALONG WITH THE TOLUENE. CYANIDE WAS NEVER DETECTED AND METALS WERE WITHIN US EPA'S DRINKING WATER STANDARDS. IN THE ORIGINAL RI WORK PLAN, SAMPLES WERE TO BE COLLECTED FROM OFF-SITE PONDS NEAR THE SITE. A SEVERE DROUGHT DURING THE SUMMER MONTHS LEFT THESE PONDS COMPLETELY DRY AND PREVENTED THE COLLECTION OF SAMPLES.

2. ON-SITE SURFACE WATER: IN MAY 1988, PRIOR TO REMOVAL ACTIVITIES, A SAMPLE (PW1) WAS COLLECTED FROM THE ON-SITE POND WHICH AT THAT TIME WAS THE ONLY ON-SITE SURFACE WATER. THE SAMPLE WAS ANALYZED FOR VOLATILE ORGANIC, SEMI-VOLATILE ORGANIC, METALS AND CYANIDE. ONLY ONE SEMI-VOLATILE, 4-METHYLPHENOL, WAS DETECTED AT 0.004 MG/L. CYANIDE WAS NOT DETECTED AND ALL DETECTED METALS WERE BELOW THE ESTABLISHED MAXIMUM CONTAMINANTS LEVELS (MCLS).

C. SEDIMENTS

1. OFF-SITE SEDIMENTS: FIVE OFF-SITE SAMPLES WERE OBTAINED IN JUNE 1988, FOUR FROM LINDERS CREEK (LCS1, LCS2, LCS1(B) AND LCS2(B)) AND ONE FROM A TRIBUTARY OF LINDERS CREEK (ITS1). SAMPLE LOCATIONS ARE SHOWN IN FIGURE 11. EACH SAMPLE WAS ANALYZED FOR VOLATILE ORGANIC, SEMI-VOLATILE ORGANIC, METALS AND CYANIDE. A SECOND SET OF SAMPLES COLLECTED FROM LINDERS CREEK WERE ANALYZED FOR VOLATILE ORGANIC ON THE TARGET COMPOUND LIST. IN ALL THREE SAMPLES, CALCIUM CONCENTRATIONS EXCEEDED THOSE DETECTED IN THE BACKGROUND SOIL SAMPLES COLLECTED NEAR THE SITE. CYANIDE WAS NOT DETECTED IN ANY SAMPLES. IN THE INTERMITTENT STREAM SAMPLE, TRICHLOROETHENE AND DI-N-BUTYL PHTHALATE WERE DETECTED AT CONCENTRATIONS OF 1.0 PPM EACH. SINCE TRICHLOROETHENE WAS NOT DETECTED AT THE SITE'S GROUNDWATER DISCHARGE POINT (BOUTWELL SPRING) OR FOUND IN SIGNIFICANT QUANTITIES ON-SITE, IT IS SUSPECTED TO BE PRESENT AT THIS LOCATION FROM AN OFF-SITE SOURCE SUCH AS FARMING/HEAVY EQUIPMENT MAINTENANCE.

2. ON-SITE SEDIMENTS: SEDIMENTS WERE COLLECTED FROM ALL THREE OF THE ON-SITE PONDS IN MAY 1988 (PS1, PS2, PS3, STS1, STS2 AND STS3). ON-GOING DROUGHT CONDITIONS DRIED UP TWO OF THE PONDS. AS WITH THE OFF-SITE SEDIMENTS, SAMPLES WERE ANALYZED FOR VOLATILE ORGANIC, SEMI-VOLATILE ORGANIC, METALS AND CYANIDE. NEITHER VOLATILE ORGANIC NOR CYANIDE WERE DETECTED. ALL DETECTED METALS, WITH THE EXCEPTION OF POTASSIUM AND MANGANESE, WERE BELOW CONCENTRATIONS FOUND IN THE LOCAL BACKGROUND SOIL SAMPLE. THE FOLLOWING SEMI-VOLATILE ORGANIC WERE IDENTIFIED: DI-N-BUTYL PHTHALATE, 4-CHLORO-3-METHYLPHENOL, 4-METHYLPHENOL AND BIS(2-ETHYLHEXYL) PHTHALATE. ONLY BIS (2-ETHYLHEXYL) PHTHALATE, A CHEMICAL COMMONLY FOUND IN PLASTICIZERS, WAS IDENTIFIED IN THE ON-SITE WASTES. THE OTHER THREE COMPOUNDS WERE SUSPECTED TO BE FROM THE DOMESTIC WASTE TRASH PILED NEAR THE POND OR FROM LABORATORY CONTAMINATION.

D. GROUNDWATER

SIX WELLS (PWW1, PWW2, PWW4, PWW5, PWW7 AND PWW8) AND FOUR SPRINGS (SPW1, SPW2, SPW3 AND SPW4) NEAR THE SITE WERE SAMPLED DURING THE GROUNDWATER INVESTIGATIONS CONDUCTED THROUGHOUT THE RI PROCESS. ANALYSES INCLUDED VOLATILE ORGANIC, SEMI-VOLATILE ORGANIC, METALS AND CYANIDE. IN ALL

SAMPLES, CYANIDE AND ORGANIC WERE NOT DETECTED AND METALS WERE WITHIN US EPA'S DRINKING WATER STANDARDS.

ADDITIONAL SAMPLING WAS CONDUCTED AT BOUTWELL SPRING, THE ONLY DISCHARGE POINT IDENTIFIED DURING THE DYE-TRACE STUDIES. SAMPLES COLLECTED IN NOVEMBER 1988 WERE ANALYZED FOR VOLATILE ORGANIC, SEMI-VOLATILE ORGANIC, METALS AND CYANIDE. THE FOLLOWING ORGANIC WERE DISCOVERED:

1,1,1-TRICHLOROETHANE	0.014 MG/L
1,2-DICHLOROETHANE	0.003 MG/L
DIETHYL PHTHALATE	0.003 MG/L

SINCE DIETHYL PHTHALATE WAS NEVER FOUND AT THE SITE IN SIGNIFICANT CONCENTRATIONS, ITS PRESENCE IN THE SAMPLE WAS ATTRIBUTED TO THE LATEX GLOVES WORN BY THE SAMPLER.

A SECOND SET OF SAMPLES FROM BOUTWELL SPRING WERE COLLECTED IN DECEMBER 1988 AFTER A HEAVY RAINFALL. THIS TIME 1,1,1-TRICHLOROETHANE WAS THE ONLY COMPOUND DETECTED AT 0.005 MG/L AND 0.006 MG/L. BOTH CONCENTRATIONS WERE BELOW THE SAFE DRINKING WATER ACT MCL OF 0.2 MG/L.

E. SOIL

1. BACKGROUND SOILS: TWO BACKGROUND SOIL SAMPLES (BRW1 AND BRW2) WERE COLLECTED OUTSIDE THE LANDFILL AREA PRIOR TO WASTE REMOVAL ACTIVITIES. ONLY ONE SEMI-VOLATILE, DI-N-BUTYL PHTHALATE, WAS FOUND IN THE BACKGROUND SAMPLES (0.4 AND 0.8 MILLIGRAMS PER KILOGRAM (MG/KG)), HOWEVER ITS PRESENCE WAS ATTRIBUTED TO LABORATORY CONTAMINATION. VOLATILE ORGANIC WERE NOT DETECTED. THE METALS FOUND IN THE BACKGROUND SAMPLES ARE PRESENTED IN TABLE 9.

2. OUTLYING SOIL: EXTENSIVE SOIL SAMPLING WAS CONDUCTED OUTSIDE THE CENTRAL SOIL TREATMENT AREA TO ESTABLISH THE LATERAL AND VERTICAL EXTENT OF ORGANIC COMPOUND AND INORGANIC METAL CONTAMINATION. LOCATIONS OF THE TWO PRIMARY WASTE STREAMS, HEAVY METAL SLUDGES AND SILICONE POLYMERS, WERE USED TO ESTABLISH THE NECESSARY ANALYSES TO BE PERFORMED ON THE SAMPLES. AREAS WHERE DRUMMED PLATING SLUDGES HAD BEEN BURIED WERE SAMPLED AND ANALYZED FOR THE ASSOCIATED METALS. AREAS WHERE DRUMMED SILICONE POLYMERS HAD BEEN BURIED WERE ANALYZED FOR THE ASSOCIATED ORGANIC COMPOUNDS. THESE PARTICULAR COMPOUNDS OF INTEREST WERE ESTABLISHED USING THE FREQUENCY AND MAGNITUDE WITH WHICH THEY OCCURRED IN THE SOIL SAMPLES, THEIR TOXICITIES AND THEIR RELATIVE ABUNDANCE IN THE WASTE STREAMS.

AREAS SURROUNDING THE CENTRAL AREA OF THE SITE WERE SAMPLED TO DELINEATE PLACES REQUIRING TREATMENT AFTER THE REMOVAL OF THE WASTE SOURCES. THE OUTLYING AREAS WERE DIVIDED INTO 8 UNITS AND THEN SAMPLED. A COMPOSITE SAMPLE WAS COLLECTED FOR EACH UNIT, COMBINING ALL THE SAMPLE LOCATIONS WITHIN THAT UNIT. EACH SAMPLE LOCATION WAS ALSO COMPRISED OF QUILTS TAKEN AT DEPTHS OF 1, 4 AND 7 FEET (WHEN POSSIBLE). FIGURE 12 OUTLINES THE SAMPLING UNITS AND LOCATIONS. UNITS 1, 2, 4 AND 5 WERE FOUND TO CONTAIN CONCENTRATIONS OF CHROMIUM, ZINC AND COPPER ABOVE THE BACKGROUND SAMPLES. TABLE 10 PRESENTS THE METALS RESULTS.

SEVERAL POCKETS OF BLUE-GRAY SLUDGES AND COPPER-CYANIDE BEARING SLUDGES WERE ENCOUNTERED DURING SAMPLING ACTIVITIES. THESE POCKETS OF SLUDGE AND SURROUNDING SOILS WERE REMOVED WITH A TRACKHOE AND EVENTUALLY TAKEN OFF-SITE FOR DISPOSAL. THE LOCATIONS OF THE SLUDGE POCKETS ARE SHOWN IN FIGURE 13.

ALL SAMPLES COLLECTED IN THE OUTLYING AREAS FOR VOLATILE ORGANIC COMPOUNDS WERE TESTED USING HEADSPACE ANALYSIS. A PORTION OF THESE SAMPLES WERE ALSO TESTED USING LABORATORY ANALYSIS. A DISCREET SAMPLE WAS COLLECTED AT EACH LOCATION, COMPOSITING ONLY THE QUILTS COLLECTED AT DIFFERENT DEPTHS. FIGURES 14 AND 15 SHOW SAMPLING LOCATIONS.

WHILE ALL SAMPLES CONTAINED SOME TRACES OF THE VOLATILE CONTAMINANTS OF INTEREST, ONLY TWO SAMPLES, BOTH COLLECTED IN THE SAME AREA, HAD CONCENTRATIONS OF 1,1,1-TRICHLOROETHANE AND TETRACHLOROETHENE ABOVE THE SOIL ACTION LEVELS (SALS) OF 7.72 MG/KG AND GT 7.5 MG/KG, RESPECTIVELY. THE DETERMINATION OF SALS IS DISCUSSED ON PAGES 19 AND 20 OF THIS DOCUMENT. THIS OUTLYING AREA UNDERWENT AERATION AS PART OF THE PILOT AERATION PROJECT WHICH IS DESCRIBED IN GREATER DETAIL ON PAGE 42 OF THIS DOCUMENT. A TRENCH MEASURING 50 FEET BY 30 FEET WAS EXCAVATED THROUGH SAMPLE BORING 4 AND THE SOIL WAS AERATED. VOLATILE ORGANIC WERE NOT FOUND IN SAMPLES THAT WERE COLLECTED AFTER THE PROJECT.

3. CENTRAL AREA SOILS: THE CENTRAL PORTION OF THE SITE CONTAINED MOST OF THE CONTAMINATED SOIL DUE TO THE LARGE AMOUNT OF NON-CONTAINERIZED WASTE BURIED IN THIS AREA. COMPOSITE SAMPLES COLLECTED IN THIS AREA DID NOT CONTAIN ANY METALS OF INTEREST ABOVE THE BACKGROUND CONCENTRATIONS. THE FOUR VOLATILE ORGANIC OF INTEREST, 1,1,1-TRICHLOROETHANE, 1,2-DICHLOROETHENE, 1,1-DICHLOROETHANE AND TETRACHLOROETHENE, WERE PRESENT IN THE CENTRAL AREA SAMPLES. SAMPLES WERE ANALYZED FOR VOLATILE ORGANIC THROUGH HEADSPACE ANALYSIS AND OFF-SITE LABORATORY ANALYSIS DURING THE SOIL AERATION PROJECT. ANALYTICAL DATA IS PRESENTED IN THE JULY 1990 RI REPORT.

SOIL AERATION PILOT STUDY

TO ESTABLISH THE EFFECTIVENESS OF AERATION FOR REMOVING THE VOLATILE ORGANIC FROM THE CENTRAL AREA SOILS, A PILOT STUDY WAS CONDUCTED USING THREE TEST PLOTS EACH CONTAINING 15 CUBIC YARDS OF SOIL AT VARYING DEPTHS: 6, 12 AND 24 INCHES. COMPOSITE SOIL SAMPLES WERE COLLECTED AND ANALYZED BOTH ON AND OFF-SITE AT THE BEGINNING AND END OF THE STUDY. A TRACKHOE ROTATED SOILS FOUR TO FIVE TIMES DAILY. SURVEYS WITH A PHOTOIONIZATION DETECTOR WERE USED TO MEASURE THE VOLATILE ORGANIC IN THE ATMOSPHERE. THE PRPS CONTRACTOR USED HEADSPACE ANALYSIS OF COMPOSITED SOIL SAMPLES TO DETERMINE WHEN THE VOLATILE CONTAMINANTS OF INTEREST WERE REDUCED TO ACCEPTABLE CONCENTRATIONS. AS SOON AS THE CONTRACTOR FELT THE SOILS HAD BEEN SUFFICIENTLY REMEDIATED, THEY WERE PLACED BACK INTO THEIR ORIGINAL TRENCHES.

BASED UPON THE DECREASE OF VOLATILE ORGANIC CONTAMINANTS IN THE 6 AND 12 INCH DEEP PLOTS, THE PILOT STUDY WAS EXPANDED TO INCLUDE THE ENTIRE CENTRAL AREA AND ONE OUTLYING AREA WHERE VOLATILE CONTAMINANTS OF INTEREST EXISTED ABOVE ACCEPTABLE SALS. THE TREATMENT OF CONTAMINATED SOIL BEGAN IN LATE NOVEMBER 1988 AND CONTINUED UNTIL MID-DECEMBER 1988. APPROXIMATELY 6,000 CUBIC YARDS OF SOIL WERE TREATED.

INITIAL STEPS INVOLVED THE EXCAVATION OF SOIL FROM TRENCHES MEASURING 100-200 FEET LONG AND 15-50 FEET WIDE (FIGURE 16). DEPTH OF EACH TRENCH DEPENDED UPON THE DEPTH TO BEDROCK OR UNDISTURBED SOIL. REMOVED SOILS WERE THEN DEPOSITED IN A DESIGNATED TREATMENT AREA ADJACENT TO EACH TRENCH (FIGURE 17). DAILY ROTO-TILLING OF SOIL WAS CONDUCTED TO PROMOTE AERATION. SOILS WERE REDEPOSITED IN THEIR ORIGINAL TRENCHES FOLLOWING HEADSPACE ANALYSIS BUT PRIOR TO OFF-SITE LABORATORY CONFIRMATION. THE TRENCHES WERE FLAGGED SO THAT IF REAERATION WAS NEEDED BASED ON THE LABORATORY RESULTS, THE TRENCHES COULD BE EASILY IDENTIFIED.

IT SHOULD BE NOTED THAT SUBSEQUENT SOIL SAMPLES FROM THE CENTRAL AREA, COLLECTED IN MARCH 1990, CONTAINED CONCENTRATIONS OF VOLATILE ORGANIC ABOVE THE SOIL ACTION LEVELS. THE PRESENCE OF THESE VOLATILE ORGANIC DOES NOT DISPEL THE EFFECTIVENESS OF SOIL AERATION FOR TREATING THE CENTRAL AREA OF THE SITE. HEADSPACE ANALYSIS CONDUCTED BY THE PRP'S CONTRACTOR WAS NOT PERFORMED ACCORDING TO THE GUIDELINES SET FORTH BY THE US EPA'S ENVIRONMENTAL SERVICES DIVISION. REMAINING CONTAMINATION MAY HAVE BEEN A RESULT OF IMPROPER PROCEDURES. THE EFFECTIVENESS OF SOIL AERATION WILL BE DETERMINED DURING THE REMEDIAL DESIGN.

#HCP

HIGHLIGHTS OF COMMUNITY PARTICIPATION

A COMMUNITY RELATIONS PLAN (CRP) FOR THE HOWE VALLEY LANDFILL SITE WAS FINALIZED ON SEPTEMBER 14, 1988. THE CRP DOCUMENTS THE CONCERNS OF INDIVIDUALS AND LOCAL OFFICIALS IN THE HOWE VALLEY AREA AND DESCRIBES ACTIVITIES SELECTED BY THE US EPA TO ADDRESS THESE CONCERNS. SPECIFIC INFORMATION WAS GATHERED DURING COMMUNITY INTERVIEWS CONDUCTED IN APRIL 1988.

THE CRP ALSO ESTABLISHES COMMUNICATION PATHWAYS TO ENSURE TIMELY DISSEMINATION OF PERTINENT INFORMATION. IN MAY 1988, A FACT SHEET OVERVIEWING THE RI PROCESS AND REMOVAL ACTIVITIES WAS DISTRIBUTED TO HOWE VALLEY RESIDENTS, LOCAL OFFICIALS AND OTHER INTERESTED PARTIES. THREE PRESS RELEASES, TWO IN JULY 1988 AND ONE IN AUGUST 1988, REPORTED THE PROGRESS OF REMOVAL AND DYE TRACE ACTIVITIES. A GENERAL INFORMATION MEETING FOR THE PUBLIC WAS HELD IN THE HOWE VALLEY ELEMENTARY SCHOOL IN JUNE 1988.

THE RI/FS REPORTS AND THE PROPOSED PLAN WERE RELEASED TO THE PUBLIC IN JULY 1990. THESE DOCUMENTS ARE AVAILABLE IN THE ADMINISTRATIVE RECORD WHICH WAS PLACED IN THE INFORMATION REPOSITORY IN THE HARDIN COUNTY PUBLIC LIBRARY, ELIZABETHTOWN, KENTUCKY. AN OFFICIAL PUBLIC COMMENT PERIOD ON THE FS REPORT AND THE PROPOSED PLAN WAS HELD FROM JULY 27, 1990 TO AUGUST 27, 1990. TO PROMOTE PUBLIC INTEREST AND TO PRESENT THE RESULTS OF THE REMEDIAL INVESTIGATION AND FEASIBILITY STUDY AND THE PREFERRED ALTERNATIVE AS DISCUSSED IN THE PROPOSED PLAN, A PUBLIC MEETING WAS HELD IN THE HOWE VALLEY ELEMENTARY SCHOOL ON AUGUST 2, 1990 ALL COMMENTS RECEIVED BY THE US EPA PRIOR TO THE END OF THE PUBLIC COMMENT PERIOD, INCLUDING THOSE EXPRESSED VERBALLY AT THE PUBLIC MEETING, ARE ADDRESSED IN THE RESPONSIVENESS SUMMARY CONTAINED IN APPENDIX A OF THIS DOCUMENT. COMMENTS FROM THE COMMONWEALTH OF KENTUCKY ARE ADDRESSED INDEPENDENTLY FROM THE RESPONSIVENESS SUMMARY AND ARE CONTAINED IN THE ADMINISTRATIVE RECORD.

#SRRA

SCOPE AND ROLE OF RESPONSE ACTION

THE RESPONSE ACTION FOR THE SITE IS INTENDED TO ADDRESS THE ON-SITE SOILS THAT STILL CONTAIN CONTAMINATION ABOVE ACCEPTABLE CONCENTRATIONS WITH REGARDS TO HUMAN HEALTH AND THE ENVIRONMENT. AS DISCUSSED, IMMEDIATE HEALTH THREATS WERE ALLEVIATED THROUGH THE REMOVAL OF WASTES FROM THE SITE. INVESTIGATIONS CONDUCTED AFTER THE REMOVAL AND SOIL AERATION STUDY REVEALED RESIDUAL CONTAMINATION WAS STILL PRESENT IN THE ON-SITE SOILS, PRIMARILY IN SEVERAL DISTINCT LOCATIONS. GROUNDWATER AND SURFACE WATER SAMPLES ESTABLISHED THAT CONTAMINATION HAD NOT MIGRATED FROM THE SITE IN CONCENTRATIONS ABOVE SAFE DRINKING LEVELS, HOWEVER THE KARST GEOLOGY LIMITED THE ABILITY TO SAMPLE GROUNDWATER DIRECTLY UNDERNEATH THE SITE.

THE SELECTED ALTERNATIVE FOR REMEDIATING THE SITE WILL ADDRESS THE CONTAMINATION REMAINING IN THE ON-SITE SOILS AND CONTAMINATION THAT COULD BE RELEASED INTO THE GROUNDWATER. THE PRINCIPAL THREAT TO HUMAN HEALTH AND THE ENVIRONMENT IS FROM THE POSSIBLE INGESTION OR DERMAL CONTACT WITH THE CONTAMINATED SOILS. A SECONDARY THREAT WOULD BE FROM INGESTION OF CONTAMINATED GROUNDWATER. CURRENTLY, GROUNDWATER SAMPLES TAKEN AT BOUTWELL SPRING INDICATE THAT CONTAMINATION IS BELOW THE MCLS OR HEALTH-BASED LEVELS. GROUNDWATER CONDITIONS AT THE SITE COULD NOT BE DETERMINED BECAUSE OF THE KARST CONDITIONS. RISKS FROM THE SITE ARE INCLUDED IN THE JULY 1990 RI REPORT AND ARE LATER SUMMARIZED IN THIS DOCUMENT.

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SUMMARY OF SITE CHARACTERISTICS

POST-REMOVAL/POST-AERATION SAMPLING OF THE SITE AND BOUTWELL SPRING WAS CONDUCTED IN MARCH 1990. RESULTS FROM THIS LATEST SAMPLING ROUND GIVE THE BEST INDICATION OF CURRENT CONDITIONS AT THE SITE.

NATURE AND EXTENT OF CONTAMINATION

APPROXIMATELY 9,150 DRUMS AND CONTAINERS OF HAZARDOUS CHEMICALS WERE DISPOSED OF AT THE HOWE VALLEY LANDFILL BETWEEN 1967 AND 1976. RESIDUAL CONTAMINATION LEFT IN THE SOIL, PRIMARILY FROM LEAKING DRUMS AND NON-CONTAINERIZED WASTES DISPOSED AT THE SITE, APPEARS TO BE THE ONLY REMAINING CONTAMINATION. ANALYSIS OF BOTH ON-SITE AND OFF-SITE SOIL, GROUNDWATER, SURFACE WATER, AND SEDIMENTS INDICATES THAT CONTAMINATION AT THE SITE IS LOCATED IN THE SUBSURFACE SOIL FROM 1 TO 9 FEET IN DEPTH. ORGANIC SUCH AS 1,1,1-TRICHLOROETHANE, 1,2-DICHLOROETHENE, 1,1-DICHLOROETHANE, AND TETRACHLOROETHENE ALONG WITH INORGANICS SUCH AS CHROMIUM, COPPER, ZINC AND CYANIDE ARE THE PRIMARY CONTAMINANTS.

SURFACE WATER

1. ON-SITE SURFACE WATER: SURFACE WATER TRAVELING ACROSS THE SITE AND INTO THE ON-SITE SINKHOLE WAS CALCULATED TO BE FLOWING AT A RATE OF APPROXIMATELY 3.8 GALLONS PER MINUTE. MEASUREMENTS WERE MADE LESS THAN 12 HOURS AFTER A MAJOR PRECIPITATION EVENT. ON-SITE SURFACE WATER FLOW RESULTING FROM STORMS IS VERY SHORT IN DURATION, USUALLY LASTING LESS THAN 24 OR 48 HOURS. BETWEEN PRECIPITATION EVENTS THERE IS NO FLOWING OR PONDED SURFACE WATER AT THE SITE.

ONLY ONE ORGANIC COMPOUND WAS DETECTED IN THE SURFACE WATER FLOWING TO THE ON-SITE SINKHOLE. ALTHOUGH 1,1,1-TRICHLOROETHANE WAS BELOW THE DETECTION LIMIT, THE CONCENTRATION WAS ESTIMATED TO BE 0.004 MG/L. THE MAXIMUM CONTAMINANT LEVEL (MCL) FOR 1,1,1-TRICHLOROETHANE IS 0.2 MG/L. ANALYTICAL RESULTS ARE PRESENTED IN TABLE 11.

2. OFF-SITE SURFACE WATER: OFF-SITE SURFACE WATER SAMPLING WAS DEPENDENT UPON THE MARCH 1990 DYE-TRACE STUDY. SINCE DYE WAS NOT DETECTED IN ANY OFF-SITE SURFACE WATERS, NO SAMPLES WERE COLLECTED. GROUNDWATER SAMPLES WERE COLLECTED FROM AREA SPRINGS AND ARE PRESENTED UNDER THE GROUNDWATER SECTION.

SEDIMENTS

1. ON-SITE SEDIMENTS: ANALYSES OF SEDIMENTS IN THE ON-SITE SINKHOLE DID NOT DETECT ANY VOLATILE ORGANIC CHEMICALS, SEMI-VOLATILE ORGANIC, PESTICIDES, OR PCBS, HOWEVER COPPER WAS DETECTED AT SLIGHTLY ELEVATED CONCENTRATIONS. THE MAJORITY OF METALS IN THE SEDIMENT WERE IRON, CALCIUM, AND ALUMINUM, NATURALLY OCCURRING METALS IN LIMESTONE AND WEATHERED CLAY. THE CYANIDE CONCENTRATION WAS 0.6 MG/KG. RESULTS OF THE ANALYSES ARE PRESENTED IN TABLE 12.

2. OFF-SITE SEDIMENTS: OFF-SITE SEDIMENT SAMPLES WERE COLLECTED AT BOUTWELL SPRING. THIS PARTICULAR SPRING WAS DETERMINED, THROUGH THREE DYE-TRACE STUDIES, TO BE THE DISCHARGE POINT FOR WATER ENTERING THE ON-SITE SINKHOLE. NO VOLATILE ORGANIC, BASE/NEUTRAL EXTRACTABLE ORGANIC, ACID EXTRACTABLE ORGANIC, PESTICIDES OR PCBS WERE DETECTED IN THE SAMPLES. THE ONLY EXCEPTION WAS PHENOL WHICH WAS ESTIMATED TO HAVE A CONCENTRATION OF 0.2 PPM. THE DRINKING WATER HEALTH-BASED STANDARD FOR PHENOL IS 4.2 PPM. METALS CONCENTRATIONS WERE BELOW U.S EPA DRINKING WATER STANDARDS. A CYANIDE CONCENTRATION OF 0.9 PPM WAS INDICATED IN THE SPRING SEDIMENT, HOWEVER, CYANIDE WAS ALSO FOUND IN THE FIELD BLANK. TABLE 12 PRESENTS THE RESULTS FOR THE ANALYSIS OF THE OFF-SITE SEDIMENT SAMPLE.

GROUNDWATER

GROUNDWATER SAMPLING INVOLVED BOTH BOUTWELL SPRING, THE ONLY DISCHARGE POINT DISCOVERED DURING THE DYE-TRACE STUDIES, AND PIRTLE SPRING, THE DRINKING WATER SOURCE FOR THE HOWE VALLEY AREA.

1. BOUTWELL SPRING: THE RESULTS OF THE BOUTWELL SPRING SAMPLES SHOWED NO DETECTABLE CONCENTRATIONS OF ACID OR BASE/NEUTRAL EXTRACTABLE ORGANIC, PCB, PESTICIDES OR VOLATILE ORGANIC.

ALL METAL CONCENTRATIONS WERE WITHIN US EPA DRINKING WATER STANDARDS.

A TRACE AMOUNT OF CYANIDE WAS DETECTED AT A CONCENTRATION OF 0.006 MG/L. THIS SAMPLE, LIKE THE SEDIMENT SAMPLE, MAY HAVE BEEN CONTAMINATED BY ANOTHER SOURCE SINCE THE FIELD BLANK ALSO CONTAINED CYANIDE AT A CONCENTRATION OF 0.008 MG/L.

2. PIRTLE SPRING: WATER FROM PIRTLE SPRING SHOWED NO DETECTABLE PESTICIDES, PCBS, BASE/NEUTRAL OR ACID EXTRACTABLE ORGANIC, VOLATILE ORGANIC, OR METALS.

ON-SITE SOILS

1. INORGANICS ANALYSES: SOIL SAMPLING FOR INORGANICS WAS UNDERTAKEN IN THE OUTLYING AREAS OF THE SITE ORIGINALLY USED FOR THE DISPOSAL OF DRUMS CONTAINING HEAVY METAL SLUDGES SUCH AS THE BLUE-GRAY PLATING SLUDGES AND THE COPPER-CYANIDE BEARING SLUDGES. FIGURE 18 SHOWS THE LOCATION OF THE OUTLYING AREAS. TOTAL SIZE OF THESE AREAS WAS APPROXIMATELY 45,000 SQUARE FEET WITH SOIL DEPTHS RANGING FROM 1 TO 3 FEET. IN ORDER TO ACCURATELY DELINEATE INORGANIC CONTAMINATION, 23 SAMPLES WERE COLLECTED AND ANALYZED FOR THE FOLLOWING CONTAMINANTS OF CONCERN: COPPER, CHROMIUM, AND ZINC. SAMPLE LOCATIONS ARE SHOWN IN FIGURE 19. THESE THREE METALS WERE SELECTED SINCE THEY WERE THE PRIMARY CONTAMINANTS IN THE SLUDGES BURIED IN THE OUTLYING AREAS. FOR INORGANICS AT THE SITE, HEALTH-BASED CLEANUP LEVELS CAN BE ESTABLISHED BY BACK-CALCULATING SOIL INGESTION RISKS TO A HAZARD INDEX OF 1 FOR EACH CHEMICAL. ASSUMING A 16 KG CHILD INGESTED 200 MG/DAY OF CONTAMINATED SOIL FOR 365 DAYS/YEAR, THE FOLLOWING SALS FOR THE CONTAMINANTS OF CONCERN WERE CALCULATED:

CHROMIUM VI	400 MG/KG
COPPER	2,300 MG/KG
ZINC	16,000 MG/KG

OF THE 23 SAMPLES, FOUR WERE ANALYZED FOR US EPA'S TARGET COMPOUND LIST(TCL) OF VOLATILE ORGANIC, SEMI-VOLATILE ORGANIC, PCBS, PESTICIDES, METALS AND CYANIDE. THIS WAS DONE TO CONFIRM THAT METALS OR ORGANIC, OTHER THAN THE CONTAMINANTS OF CONCERN, DID NOT EXIST IN THE ON-SITE SOILS.

TABLE 13 PRESENTS THE RESULTS OF THE INORGANIC SAMPLING AND TABLE 14 PRESENTS THE TCL RESULTS. LOCATIONS WHERE CONTAMINANTS WERE FOUND ABOVE SALS ARE SHOWN IN FIGURE 20. CHROMIUM WAS THE ONLY METAL FOUND TO EXCEED THE SITE SAL. THIS OCCURRED IN TWO SURFACE LOCATIONS AT CONCENTRATIONS OF 680/690 MG/KG AND 1,700/1,800 MG/KG. COINCIDENTLY, BOTH LOCATIONS HAD BEEN PREVIOUSLY SELECTED TO UNDERGO DUPLICATE ANALYSIS.

2. ORGANIC ANALYSES: SOIL SAMPLING FOR ORGANIC, WITH THE EXCEPTION OF THE TCL SAMPLES IN THE OUTLYING AREAS, WAS LIMITED TO THE CENTRAL AREA OF THE SITE WHERE SILICONE COMPOUNDS HAD BEEN DISPOSED. PREVIOUS ORGANIC SAMPLING WAS CONDUCTED IN THE OUTLYING AREAS AND THE ONLY LOCATION FOUND TO EXCEED THE SALS WAS AERATED. THE APPROXIMATE SIZE OF THE CENTRAL AREA IS 50,000 SQUARE FEET. SOIL DEPTHS RANGE FROM 1 TO 3 FEET NEAR THE EDGES AND UP TO 9 FEET IN THE MIDDLE. TWELVE LOCATIONS WERE SELECTED FOR SAMPLING. SAMPLES WERE TAKEN AT THE SURFACE, AT 3 FEET AND AT BEDROCK (USUALLY BETWEEN 6 AND 9 FEET). IN TOTAL, 38 SAMPLES WERE COLLECTED AND ANALYZED FOR THE FOLLOWING ORGANIC: 1,1-DICHLOROETHANE, 1,2-DICHLOROETHENE, 1,1,1-TRICHLOROETHANE AND TETRACHLOROETHENE. ONE LOCATION ALONG THE WESTERN SIDE OF THE CENTRAL AREA WAS CHOSEN TO UNDERGO TCL ANALYSIS FOR VOLATILE ORGANIC, BASE/NEUTRAL AND ACID EXTRACTABLES, PESTICIDES, PCBS, CYANIDE AND METALS.

THE FOUR ORGANIC LISTED ABOVE WERE SELECTED FOR ANALYSIS BECAUSE THEY WERE REPEATEDLY FOUND IN WASTE SAMPLES AND SITE SAMPLES MORE FREQUENTLY AND IN HIGHER CONCENTRATIONS THAN ANY OTHER COMPOUNDS. ALL ARE SLIGHTLY SOLUBLE, WITH THE EXCEPTION OF 1,1-DICHLOROETHANE WHICH IS ALMOST

INSOLUBLE. THEIR PRIMARY TRANSPORT PROCESS IS VOLATILIZATION WHILE THE PREDOMINANT ENVIRONMENTAL FATE DETERMINING PROCESS IS OXIDATION. PERSISTENCE OF THESE ORGANIC IS FAIRLY LOW. WHEN OXIDATION PROCEEDS AT A NORMAL RATE, A TYPICAL HALF-LIFE CAN RANGE FROM SEVERAL HOURS TO TWO MONTHS. THE ONLY EXCEPTION IS FOR 1,1,1-TRICHLOROETHANE WHICH HAS A HALF-LIFE OF FIVE MONTHS TO 8 YEARS. THE MOST TOXIC COMPOUND OF THE FOUR IS TETRACHLOROETHENE. IT SHOULD BE NOTED THAT SIGNIFICANT LEVELS OF TETRACHLOROETHENE CONCENTRATIONS STILL REMAINED 16 MONTHS AFTER POST-REMOVAL SAMPLING, INDICATING THAT OXIDATION IN THE ON-SITE SUBSURFACE SOILS IS PROCEEDING AT A VERY SLOW RATE.

NO FEDERAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) HAVE BEEN DEVELOPED FOR CONTAMINANTS IN SOIL MEDIA. ACTION LEVELS FOR SOIL CLEANUP OF ORGANICS AT THE SITE WERE ESTABLISHED BASED UPON MCLS AND AS A FUNCTION OF THE SOIL PARTITIONING COEFFICIENT (KD) VALUES FOR INDIVIDUAL COMPOUNDS AND GROUNDWATER CONCENTRATIONS RESULTING FROM THE PARTITIONING OF THESE COMPOUNDS INTO THE LIQUID PHASE. THE KD VALUES WERE DETERMINED DURING SOIL COLUMN TESTS.

$$KD = \frac{\text{MASS OF SOLUTE ON SOLID PHASE}}{\text{UNIT MASS PER SOLID PHASE}} \times \frac{\text{MASS OF SOLUTE IN LIQUID PHASE}}{\text{VOLUME OF SOLUTION}}$$

A MORE DETAILED EXPLANATION IS CONTAINED IN APPENDIX C OF THE JULY 1990 RI REPORT. THE SALS CALCULATED USING THE KD DATA WERE COMPARED WITH HEALTH-BASED CRITERIA AND THE MORE CONSERVATIVE VALUE WAS IMPLEMENTED. THE RATIONALE FOR THIS APPROACH CONSIDERED THE FACT THAT A KD CALCULATION IS NOT REPRESENTATIVE OF GROUND-WATER FLOW IN A KARST TERRAIN. THE SALS WERE ESTABLISHED TO PROTECT HUMAN HEALTH AND THE ENVIRONMENT. SAFE DRINKING WATER ACT MCLS AND HEALTH-BASED LEVELS (WHEN MCLS WERE NOT AVAILABLE) WERE USED AS CLEANUP CRITERIA FOR PROTECTION OF GROUNDWATER. THE SALS FOR THE SITE ARE LISTED BELOW (1,1-DICHLOROETHANE DOES NOT HAVE A DRINKING WATER STANDARD FROM WHICH TO CALCULATE AN SAL):

1,1,1-TRICHLOROETHANE	117.30 MG/KG
1,2-DICHLOROETHENE	7.72 MG/KG
TETRACHLOROETHENE	GT 7.50 MG/KG

RESULTS OF THE SAMPLING ARE PRESENTED IN TABLE 15 AND ARE DISCUSSED BELOW. TETRACHLOROETHENE WAS FOUND IN ONE SURFACE LOCATION ABOVE ITS SAL. THE ACTUAL CONCENTRATION WAS 80 MG/KG. THE OTHER THREE ORGANICS WERE NOT DETECTED IN ANY OF THE SURFACE SOIL SAMPLES.

SAMPLES COLLECTED AT 3 FEET CONTAINED 1,1,1-TRICHLOROETHANE, 1,2-DICHLOROETHENE AND TETRACHLOROETHENE ABOVE THEIR SALS. THE BROADEST SPACIAL DISTRIBUTION AT THIS DEPTH WAS FOUND FOR THE COMPOUND TETRACHLOROETHENE. ONLY ONE SAMPLE TAKEN AT 3 FEET CONTAINED 1,1-DICHLOROETHANE ABOVE ITS DETECTION LIMIT. FOR SAMPLES DEEPER THAN 3 FEET, PRIMARILY AT 6 AND 9 FEET, 1,1,1-TRICHLOROETHANE AND TETRACHLOROETHANE WERE FOUND ABOVE THEIR SALS. CONCENTRATIONS AND LOCATIONS ARE PRESENTED IN FIGURES 21 THROUGH 26.

3. CYANIDE ANALYSES: FIVE LOCATIONS, FOUR IN THE OUTLYING AREA AND ONE IN THE CENTRAL AREA, WERE SELECTED TO UNDERGO TCL ANALYSIS WHICH INCLUDED ANALYSIS FOR CYANIDE. OUT OF A TOTAL OF NINE SAMPLES COLLECTED, FOUR HAD DETECTABLE CONCENTRATIONS OF CYANIDE; THREE SAMPLES BELOW 1 MG/KG AND ONE AT 3.6 MG/KG. THE CALCULATED HEALTH-BASED SOIL ACTION LEVEL FOR CYANIDE IS 1,600 MG/KG.

SUMMARY

APPROXIMATELY 7,500 CUBIC YARDS OF NEAR-SURFACE AND SUBSURFACE SOILS DEEPER THAN 6 INCHES ARE THE PRIMARY CONTAMINANT SOURCES REMAINING AT THE SITE. ALTHOUGH TWO LOCATIONS WERE FOUND TO CONTAIN TOTAL CHROMIUM CONCENTRATIONS ABOVE THE SAL, 1,1,1-TRICHLOROETHANE, TETRACHLOROETHENE AND 1,2-DICHLOROETHENE ARE THE MAJOR CONTAMINANTS AT THE SITE. THESE VOLATILE ORGANIC COMPOUNDS

WERE FOUND IN THE CENTRAL PORTION OF THE SITE WHERE NON-CONTAINERIZED WASTES WERE BURIED. INDIVIDUAL LOCATIONS IN THE CENTRAL AREA EXHIBITED TRICHLOROETHENE CONCENTRATIONS FROM AS LOW AS NONE DETECTABLE TO AS HIGH AS 800 PPM (BELOW 3 FEET DEEP). IT MUST BE NOTED THAT SAMPLES ANALYZED FOR THE TOTAL COMPOUND LIST DID SHOW VERY LOW LEVELS OF INORGANICS IN THE CENTRAL AREA AND TRACES OF ORGANICS IN THE OUTLYING AREAS, HOWEVER NEITHER THE INORGANICS NOR THE ORGANICS IN THESE LOCATIONS WERE FOUND AT CONCENTRATIONS THAT CAUSED A HEALTH OR ENVIRONMENTAL RISK.

CONTAMINATED SOIL VOLUMES WERE ESTIMATED USING TOPOGRAPHIC SURVEY DATA AND AN OVERBURDEN THICKNESS MAP. BOTH AN OVERBURDEN THICKNESS MAP (FIGURE 27) AND A CROSS SECTIONAL PROFILE OF THE SITE (FIGURE 28) ARE SHOWN ON THE FOLLOWING PAGES. THE EXTENT OF CONTAMINATION REMAINING AT THE SITE IS DEPICTED IN FIGURE 29. THE CALCULATED VOLUMES ARE PRESENTED BELOW:

METAL CONTAMINATED AREAS

AREA 1: 35 FEET X 35 FEET X 0.25 FEET = 11 CUBIC YARDS
AREA 2: 35 FEET X 35 FEET X 2.00 FEET = 91 CUBIC YARDS
TOTAL: 102 CUBIC YARDS OF ON-SITE SOIL

ORGANIC CONTAMINATED AREAS

AREA 3: (0.5 X 205 FEET) X 102 FEET X 5.1 FEET = 1,975 CUBIC YARDS
AREA 4: 102 FEET X 102 FEET X 4.5 FEET = 1,734 CUBIC YARDS
AREA 5: 102 FEET X 170 FEET X 5.8 FEET = 3,725 CUBIC YARDS
TOTAL: 7,434 CUBIC YARDS OF ON-SITE SOIL

PATHWAYS OF MIGRATION

EXPOSURE TO AIR AND WARMER TEMPERATURES, CAUSES THE VOLATILIZATION OF ORGANICS LOCATED NEAR THE SURFACE OF THE SITE. THE VERY SMALL PORE SPACES IN THE CLAYEY SUBSURFACE SOILS PROHIBIT RAPID VOLATILIZATION OF THE DEEPER VOLATILE ORGANICS. ONLY AT A VERY SLOW RATE OVER A PERIOD OF YEARS WOULD THESE COMPOUNDS BE ABLE TO DIFFUSE THROUGH THE SOIL AND REACH THE SURFACE WHERE THEY COULD ESCAPE INTO THE ATMOSPHERE. TYPICALLY, SUCH TRAPPED ORGANICS UNDERGO BIODEGRADATION, HOWEVER THE PROCESS AT THIS SITE IS ESTIMATED TO PROCEED QUITE SLOWLY.

ORGANIC CONTAMINANTS CAN MIGRATE FROM THE SOIL TO THE GROUNDWATER BENEATH THE SITE AS RAINWATER PERCOLATES DOWNWARD THROUGH THE SOIL COLUMN. SOIL ACTION LEVELS WERE BACK-CALCULATED FOR 1,2-DICHLOROETHENE, 1,1,1-TRICHLOROETHANE AND TETRACHLOROETHENE IN ORDER TO PROTECT GROUNDWATER AT THE SITE. DUE TO THE LOWER CONCENTRATION OF 1,1-DICHLOROETHANE ON-SITE AND ITS INSOLUBILITY IN WATER, A SAL FOR 1,1-DICHLOROETHANE WAS NOT CALCULATED. THE DEGREE TO WHICH A COMPOUND WILL TEND TO REMAIN ATTACHED TO THE SOIL AS WATER PASSES THROUGH THE SOIL CAN BE DESCRIBED BY ITS SOIL/WATER PARTITION COEFFICIENT (KD). THE HIGHER THE KD, THE MORE THAT COMPOUND TENDS TO BE RETAINED BY THE SOIL. FOR THE COMPOUNDS OF CONCERN PRESENT AT THE SITE, THE KD RANGED FROM 1.47 FOR 1,2-DICHLOROETHENE TO LESS THAN 20 FOR TETRACHLOROETHENE. PHYSICAL ANALYSIS OF THE SITE SOILS (AS SHOWN IN TABLE 16), INDICATE THAT THE HYDRAULIC CONDUCTIVITY OF THE SOIL IS LOW. EVEN THOUGH THE SITE SOILS ARE RELATIVELY IMPERMEABLE, RAINWATER WILL STILL PERCOLATE DOWN THROUGH THE SOIL, DISSOLVING CONTAMINANTS TO A DEGREE DEPENDENT ON EACH CONTAMINANTS' KD. EVENTUALLY, THE GROUNDWATER BENEATH THE SITE, CONTAINING LEACHED CONTAMINANTS FROM THE SOIL, WILL FLOW THROUGH THE UNDERGROUND CONDUITS FORMED BY NATURAL DISSOLUTION OF THE LIMESTONE BEDROCK TOWARDS BOUTWELL SPRING AND INTO LINDERS CREEK.

AN ADDITIONAL ROUTE FOR MIGRATION WOULD BE SURFACE WATER RUNNING ACROSS THE SITE. SUCH WATER, ALTHOUGH PRESENT ONLY DURING AND IMMEDIATELY AFTER PRECIPITATION EVENTS, COULD CARRY SURFACE CONTAMINANTS, EITHER DISSOLVED INTO THE WATER OR ADSORBED ONTO SOIL PARTICLES, INTO THE ON-SITE SINKHOLE OR ONTO PROPERTY ADJACENT TO THE SITE.

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SUMMARY OF SITE RISKS

A BASELINE RISK ASSESSMENT WAS CONDUCTED FOR THE HOWE VALLEY LANDFILL SITE AND IS PRESENTED IN THE RISK ASSESSMENT SECTION OF THE JULY 1990 RI REPORT. THE RISK ASSESSMENT CONSISTED OF THE IDENTIFICATION OF CHEMICALS OF INTEREST, AN EXPOSURE ASSESSMENT, A TOXICITY ASSESSMENT, AND THE CHARACTERIZATION OF ENVIRONMENTAL AND HUMAN HEALTH RISKS.

IDENTIFICATION OF CONTAMINANTS OF CONCERN

THE IDENTIFICATION OF HAZARDS AT THE SITE BEGAN WITH THE SELECTION OF THE CONTAMINANTS OF CONCERN. THESE CONTAMINANTS WERE FOUND IN THE ENVIRONMENT DURING THE RI AND HAVE INHERENT TOXIC AND/OR CARCINOGENIC EFFECTS THAT COULD THREATEN THE PROTECTION OF PUBLIC HEALTH AND THE ENVIRONMENT. THREE INORGANIC METALS, COPPER, CHROMIUM AND ZINC, AND CYANIDE WERE CONSIDERED POTENTIAL CONTAMINANTS OF CONCERN DUE TO THE PRESENCE OF DRUMMED HEAVY METAL PLATING WASTES BURIED AT THE SITE.

ONE ACID EXTRACTABLE ORGANIC COMPOUND, 4-METHYLPHENOL, WAS DETECTED IN ONE SAMPLE FROM THE ON-SITE POND. SINCE IT WAS NOT DETECTED IN SUBSEQUENT SAMPLING ACTIVITIES AND NEVER DETECTED IN ANY WASTE SAMPLES, IT WAS NOT CONSIDERED A CONTAMINANT OF CONCERN. ADDITIONALLY, SIX BASE/NEUTRAL EXTRACTABLE ORGANIC COMPOUNDS WERE DETECTED IN ON-SITE SOIL SAMPLES. TWO OF THESE COMPOUNDS, NAPHTHALENE AND 2-METHYLNAPHTHALENE WERE FOUND IN ONLY ONE SAMPLE IN CONCENTRATIONS BELOW DETECTION LIMITS, THEREFORE THEY WERE DISCOUNTED AS CHEMICALS OF INTEREST. THE REMAINING FOUR BASE/NEUTRAL EXTRACTABLE ORGANICS, DI-N-BUTYL PHTHALATE, BUTYL BENZYL PHTHALATE, DIETHYL PHTHALATE AND BIS (2-ETHYLHEXYL) PHTHALATE, WERE ALSO DISCOUNTED AS CONTAMINANTS OF CONCERN. DI-N-BUTYL PHTHALATE WAS SUSPECTED TO BE A RESULT OF LABORATORY CONTAMINATION SINCE IT WAS FOUND IN TRACE QUANTITIES IN A MAJORITY OF SAMPLES, INCLUDING THE FIELD AND LABORATORY BLANKS. BUTYL BENZYL PHTHALATE WAS ALSO A RESULT OF LABORATORY CONTAMINATION, WHERE AS DIETHYL PHTHALATE WAS A RESULT OF FIELD CONTAMINATION FROM THE SAMPLER'S LATEX GLOVES. BIS (2-ETHYLHEXYL) PHTHALATE, WHICH DEGRADES FAIRLY QUICKLY AND IS ALMOST INSOLUBLE IN WATER, WAS FOUND IN 1988 IN SAMPLES TAKEN FROM THE INSULATION PILE AND THE UNDERLYING SOIL. SINCE THIS COMPOUND WAS DISCOVERED IN ONLY ONE MARCH 1990 SOIL SAMPLE (ESTIMATED CONCENTRATION OF 0.3 PPM) IT WAS NOT RETAINED AS A CONTAMINANT OF INTEREST.

THREE VOLATILE ORGANIC COMPOUNDS WERE REPEATEDLY DETECTED IN SIGNIFICANT CONCENTRATIONS IN THE ON-SITE SOILS. THEY WERE ALSO THE PRIMARY CONSTITUENTS OF THE WASTES FOUND ON-SITE, THEREFORE THEY WERE SELECTED AS CONTAMINANTS OF CONCERN. ALTHOUGH 1,1-DICHLOROETHANE WAS DETECTED IN WASTES REMOVED FROM THE SITE AND IN SAMPLES COLLECTED IN 1988, IT WAS DETECTED IN ONLY ONE 1990 SAMPLE AT VERY LOW CONCENTRATIONS. AS A RESULT, IT WAS NOT CONSIDERED A CONCERN AT THE SITE. SELECTED CONTAMINANTS OF CONCERN ARE:

INORGANICS - COPPER
- CHROMIUM
- ZINC
- CYANIDE

ORGANICS - 1,2-DICHLOROETHENE
- 1,1,1-TRICHLOROETHANE
- TETRACHLOROETHENE

DOSE-RESPONSE EVALUATION

THE DOSE-RESPONSE EVALUATION PRESENTED AVAILABLE HUMAN HEALTH AND ENVIRONMENTAL CRITERIA FOR THE CONTAMINANTS OF CONCERN, AND RELATED THE CHEMICAL EXPOSURE (DOSE) TO EXPECTED ADVERSE HEALTH

EFFECTS (RESPONSE). AN EXPLANATION OF HOW THESE VALUES WERE DERIVED AND HOW THEY SHOULD BE APPLIED IS PRESENTED BELOW.

CANCER POTENCY FACTOR (CPFS) HAVE BEEN DEVELOPED BY THE US EPA'S CARCINOGENIC ASSESSMENT GROUP FOR ESTIMATING EXCESS LIFETIME CANCER RISKS ASSOCIATED WITH EXPOSURE TO POTENTIALLY CARCINOGENIC CHEMICALS. CPFS, WHICH ARE EXPRESSED IN UNITS OF (MG/KG/DAY)⁻¹, ARE MULTIPLIED BY THE ESTIMATED INTAKE OF A POTENTIAL CARCINOGEN, IN MG/KG/DAY, TO PROVIDE AN UPPER BOUND ESTIMATE OF THE EXCESS LIFETIME CANCER RISK ASSOCIATED WITH EXPOSURE AT THAT INTAKE LEVEL. THE TERM "UPPER BOUND" REFLECTS THE CONSERVATIVE ESTIMATE OF THE RISKS CALCULATED FROM THE CPF. USE OF THIS APPROACH MAKES UNDERESTIMATING OF THE ACTUAL CANCER RISK HIGHLY UNLIKELY. CPFS ARE DERIVED FROM THE RESULTS OF HUMAN EPIDEMIOLOGICAL STUDIES OR CHRONIC ANIMAL BIOASSAYS TO WHICH ANIMAL-TO-HUMAN EXTRAPOLATION AND UNCERTAINTY FACTORS HAVE BEEN APPLIED.

REFERENCE DOSES (RFDs) HAVE BEEN DEVELOPED BY THE US EPA FOR INDICATING THE POTENTIAL FOR ADVERSE HEALTH EFFECTS FROM EXPOSURE TO CHEMICALS EXHIBITING NONCARCINOGENIC EFFECTS. RFDs, WHICH ARE EXPRESSED IN UNITS OF MG/KG/DAY, ARE ESTIMATES OF LIFETIME DAILY EXPOSURE LEVELS FOR HUMANS, INCLUDING SENSITIVE INDIVIDUALS. ESTIMATED INTAKES OF CHEMICALS FROM ENVIRONMENTAL MEDIA (E.G., THE AMOUNT OF A CHEMICAL INGESTED FROM CONTAMINATED DRINKING WATER) CAN BE COMPARED TO THE RFD. RFDs ARE DERIVED FROM HUMAN EPIDEMIOLOGICAL STUDIES OR ANIMAL STUDIES TO WHICH UNCERTAINTY FACTORS HAVE BEEN APPLIED (E.G., TO ACCOUNT FOR THE USE OF ANIMAL DATA TO PREDICT THE EFFECTS ON HUMANS). THESE UNCERTAINTY FACTORS HELP ENSURE THAT THE RFDs WILL NOT UNDERESTIMATE THE POTENTIAL FOR ADVERSE NONCARCINOGENIC EFFECTS TO OCCUR.

FOR NONCARCINOGENS, THE RISK TO HUMAN POPULATIONS IS DETERMINED BY COMPARING THE RFD TO THE CHRONIC DAILY INTAKE (CDI). THE CDI IS THE LONG-TERM DAILY CONCENTRATION OF A CHEMICAL TO WHICH AN INDIVIDUAL IS EXPOSED. A HAZARD INDEX (HI) OF LESS THAN ONE TYPICALLY INDICATES THAT THERE ARE NO APPRECIABLE RISKS.

$$\text{NONCARCINOGENS:} \quad \frac{(\text{CDI})}{(\text{RFD})} = \text{HAZARD INDEX}$$

THE PRODUCT OF THE CPF AND CDI PROVIDES AN ESTIMATE OF LIFETIME CANCER RISKS TO HUMAN POPULATIONS.

$$\text{CARCINOGENS:} \quad (\text{CDI} \times \text{CPF}) = \text{LIFETIME CANCER RISK}$$

THE LIFETIME CANCER RISK IS THE PROBABILITY THAT A SPECIFIC ADVERSE EFFECT WILL OCCUR UNDER THE DEFINED CONDITIONS OF EXPOSURE. THIS PARTICULAR METHOD ASSUMES THAT CANCER RISKS ARE ADDITIVE SO THAT THE OVERALL CANCER RISK CAN BE ESTABLISHED BY SUMMING THE INCREMENTAL RISKS.

FOR CARCINOGENS OR SUSPECTED CARCINOGENS, A QUANTITATIVE RISK ASSESSMENT INVOLVES CALCULATING THE RISK LEVELS CONSIDERED TO REPRESENT THE PROBABILITY OR RANGE OF PROBABILITIES OF DEVELOPING ADDITIONAL INCIDENCES OF CANCER UNDER THE PRESCRIBED EXPOSURE CONDITIONS. THE EXPRESSED RISKS ARE PROBABILITIES GENERALLY EXPRESSED IN SCIENTIFIC NOTATION (E.G. $1 \times (10^{-6})$). AN EXCESS LIFETIME CANCER RISK OF $1 \times (10^{-6})$ INDICATES THAT, AS A PLAUSIBLE UPPER BOUND ESTIMATE, AN INDIVIDUAL HAS A ONE IN ONE MILLION CHANCE OF DEVELOPING CANCER OVER A 70-YEAR LIFETIME AS A RESULT OF SITE-RELATED EXPOSURE TO A CARCINOGEN. THESE CALCULATED RISK ESTIMATES SHOULD BE EVALUATED AGAINST A TARGET LEVEL.

RISK LEVELS OF $1 \times (10^{-4})$ TO $1 \times (10^{-6})$ CAN BE USED TO DETERMINE THE "ENVIRONMENTAL SIGNIFICANCE" OF THE RISK INCURRED AND ARE USED AS A TARGET RANGE FOR REMEDIAL PURPOSES (US EPA, 1988). A RISK LEVEL GREATER THAN $1 \times (10^{-4})$ IS CONSIDERED TO PRESENT AN UNACCEPTABLE RISK WITH REGARD TO HUMAN HEALTH IN AN ENVIRONMENTAL CONTEXT, WHEREAS RISK LEVELS LESS THAN $1 \times (10^{-6})$ ARE CONSIDERED ACCEPTABLE BY EPA. THE TERM "INSIGNIFICANT" IS NOT MEANT TO IMPLY ACCEPTABILITY;

HOWEVER, IT PUTS NUMERICAL RISK ESTIMATES INTO PERSPECTIVE.

EXPOSURE AND TOXICITY ASSESSMENT

THE EXPOSURE ASSESSMENT IDENTIFIED POTENTIAL PATHWAYS AND ROUTES FOR CONTAMINANTS OF CONCERN TO REACH THE RECEPTORS AND THE ESTIMATED CONTAMINANT CONCENTRATION AT THE POINTS OF EXPOSURE. CONTAMINANT RELEASE MECHANISMS FROM ENVIRONMENTAL MEDIA WERE ALSO PRESENTED.

AT THE HOWE VALLEY LANDFILL, THE CURRENT RECEPTOR POPULATION WAS IDENTIFIED AS LIMITED TO THE RESIDENTIAL COMMUNITY SURROUNDING THE SITE AND PERSONS THAT USE THE SITE FOR HIKING, HUNTING AND RIDING DIRT BIKES OR ALL-TERRAIN VEHICLES.

THE POTENTIAL EXPOSURE PATHWAYS EVALUATED INCLUDED THE DIRECT OR INCIDENTAL INGESTION OF SURFACE WATER AND THE INHALATION OF DUST PRODUCED BY DIRT BIKES OR ALL-TERRAIN VEHICLES. EXPOSURE TO SITE SUBSURFACE SOIL DEEPER THAN 6 INCHES WAS NOT ANTICIPATED TO OCCUR UNDER CURRENT CONDITIONS OR FUTURE-USE CONDITIONS. FUTURE RECEPTOR POPULATIONS COULD INCLUDE RESIDENTS LIVING IN A HOUSE BUILT ON THE SITE. UNDER SUCH A FUTURE SCENARIO, POTENTIAL EXPOSURE PATHWAYS WOULD BE THE SAME AS THOSE PREVIOUSLY MENTIONED BUT SHOULD ALSO INCLUDE THE DIRECT CONTACT AND/OR THE INGESTION OF GROUNDWATER.

OFF-SITE PATHWAYS WERE NOT EVALUATED IN THE RISK ASSESSMENT BECAUSE SIGNIFICANT CONTAMINATION ATTRIBUTABLE TO THE SITE WAS NOT FOUND OFF-SITE. DURING HIGH WATER FLOW PERIODS, SOME SURFICIAL SOIL AND SEDIMENTS COULD BE FLUSHED INTO THE ON-SITE SINKHOLE, HOWEVER THE DILUTION AND SPATIAL DISTRIBUTION OFF-SITE WOULD DECREASE CONTAMINANT CONCENTRATIONS TO BELOW DETECTION LIMITS.

RISK CHARACTERIZATION

IN THIS RISK ASSESSMENT BOTH THE PROBABLE AVERAGE RISK (PAR) AND THE POSSIBLE MAXIMUM RISK (PMR) WERE CALCULATED FOR EACH GROUP OF CHEMICALS. THE PAR USED MOST PROBABLE EXPOSURE ASSUMPTIONS TO ESTIMATE AVERAGE RISK. THE PMR INCREASED EXPOSURE ASSUMPTION VALUES TO ESTIMATE THE MAXIMUM RISK THAT WOULD BE EXPECTED TO BE EXPERIENCED BY AN INDIVIDUAL.

A. CURRENT SITE USE

THE FOLLOWING SCENARIO WAS BASED UPON THE ASSUMPTION THAT AN INDIVIDUAL COULD ACCESS THE SITE EITHER BY FOOT OR BY VEHICLE. CURRENTLY, WARNING SIGNS ARE POSTED AT THE PRIMARY ENTRANCES, HOWEVER THE SITE IS STILL ACCESSABLE. THE RISK ASSESSMENT FOR CURRENT SITE USAGE ASSUMED THAT A LOCAL INDIVIDUAL COULD ACCESS THE SITE FOR A TOTAL OF 55 YEARS; AS A CHILD (6-11 YEARS OLD) AND AS AN ADULT (12-62 YEARS OLD). USING INFORMATION FROM THE NATIONAL WEATHER SERVICE IN LOUISVILLE, KENTUCKY, IT WAS ALSO ASSUMED THAT WEATHER CONDITIONS WOULD ONLY BE FAVORABLE FOR CHILDREN TO PLAY AT THE SITE 120-180 DAYS PER YEAR. OF THESE DAYS, A CHILD WOULD ONLY PLAY AT THE SITE 67 PERCENT OF THE TIME OR 40-60 DAYS.

OLDER CHILDREN, ABOVE AGE 12, AND ADULTS WERE ASSUMED TO HUNT ON THE SITE FOR AN AVERAGE OF 20.8 DAYS PER YEAR (US DEPARTMENT OF THE INTERIOR AND US DEPARTMENT OF COMMERCE). FOR CALCULATION PURPOSES, THE FREQUENCY WAS ASSUMED TO BE 20 DAYS PER YEAR FOR THE PAR AND 40 DAYS PER YEAR FOR THE PMR. FOR LIFETIME USAGE, A 25-YEAR DURATION WAS UTILIZED FOR THE PAR AND 50 YEARS FOR THE PMR.

RISK CALCULATIONS ASSUMED THAT A CHILD BETWEEN 9 AND 10 YEARS OLD WOULD WEIGH APPROXIMATELY 30 KG OR 66 LBS. THE CONTACT RATE WAS ESTABLISHED FROM THE ESTIMATED EXPOSURE SURFACE AREA FOR THE ARMS AND HANDS OF 1880 CM² AND A CONTACT RATE OF 0.5-1.5 MG/CM². THE RESULTANT SOIL CONTACT RATE WAS 940 MG/DAY FOR THE PAR AND 2820 MG/DAY FOR THE PMR. THE AVERAGE WEIGHT AND YEARS OF EXPOSURE FOR AN ADULT AT THE SITE WAS ASSUMED TO BE 70 KG AND 70 YEARS.

1. RISK FROM ON-SITE SURFACE SOIL: THE SOIL INGESTION RATE FOR A CHILD AT THE SITE FOR THE PAR AND THE PMR WERE ASSUMED TO BE 100 MG/DAY AND 200 MG/DAY, RESPECTIVELY (US EPA, 1989). THE ADULT SOIL INGESTION RATE WAS CALCULATED TO BE 50 MG/DAY FOR THE PAR AND 100 MG/DAY FOR THE PMR. SOIL CONTACT RATES WERE 495 MG/DAY (PAR) AND 1485 MG/DAY (PMR). ABSORPTION PERCENTAGES WERE 10 PERCENT FOR VOLATILE ORGANICS AND 0 PERCENT FOR INORGANICS. WHEN THE RISK WAS RECALCULATED ASSUMING 1 PERCENT DERMAL ABSORPTION OF INORGANICS FROM SOIL, THE RISK WAS NOT SIGNIFICANTLY INCREASED (RESULTS NOT TABLED). A SUMMARY OF THE RISK ASSESSMENT CRITERIA IS PRESENTED IN THE RISK ASSESSMENT SECTION AND APPENDIX G OF THE JULY 1990 RI REPORT.

INDIVIDUAL RISKS, CALCULATED FOR EACH SOIL SAMPLE LOCATION, ARE PRESENTED IN TABLE 17. FIGURE 30 WAS INCLUDED TO SHOW THE SAMPLING LOCATIONS. THE TOTAL LIFETIME CANCER RISK ASSOCIATED WITH EXPOSURE TO ON-SITE SOILS AT A SPECIFIC LOCATION RANGED FROM NO DETECTABLE INCREASE IN RISK TO A MAXIMUM RISK OF $1 \times (10^{-6})$. THE AVERAGE RISK ASSOCIATED WITH EXPOSURE WAS $1 \times (10^{-9})$ AND $5 \times (10^{-9})$ FOR THE PAR AND PMR, RESPECTIVELY. THE TOTAL HI FOR NONCARCINOGENS AVERAGED FROM $2 \times (10^{-3})$ (PAR) TO $7 \times (10^{-3})$ (PMR). RETURNING TO THE SAME AREA FOR A LIFETIME COULD RESULT IN A RISK WITH A MAXIMUM CALCULATED HI OF 0.4. NO HIS WERE ABOVE 1, INDICATING RISKS ARE MINIMAL.

2. RISKS FROM ON-SITE SURFACE WATER: ALTHOUGH ON-SITE SURFACE WATERS ARE EPHEMERAL AND SHALLOW, FOR THE RISK ASSESSMENT THEY WERE ASSUMED TO BE 1 FOOT IN DEPTH; DEEP ENOUGH FOR EXPOSURE TO HANDS, FEET AND LOWER LEGS. THE AVERAGE TOTAL BODY SURFACE AREA FOR A 9 TO 10 YEAR OLD MALE CHILD WAS 10,700 CM². THE SURFACE AREA POTENTIALLY EXPOSED TO SURFACE WATER WAS CALCULATED TO BE 2,675 CM². DURATION OF A CHILD'S EXPOSURE FOR THE PAR AND PMR WERE 30 MINUTES AND 60 MINUTES, RESPECTIVELY. ASSUMING HUNTERS WORE WATERPROOF BOOTS, THE DURATION OF CONTACT WAS 15 TO 30 MINUTES. FOR ADULTS STANDING IN SURFACE WATER, THE EXPOSURE AREA WAS 2,200 CM².

SINCE PONDS DO NOT EXIST ON-SITE AND THE INTERMITTENT STREAMS ONLY FLOW AFTER PRECIPITATION EVENTS, THE RISK CALCULATIONS FOR SURFACE WATERS INCLUDED ONLY THE ONE SAMPLE COLLECTED IN MARCH 1990. ACTUAL CONCENTRATIONS IN THE SAMPLE WERE USED TO CALCULATE RISKS. NO CARCINOGENIC COMPOUNDS WERE FOUND, THEREFORE THEIR RISKS COULD NOT BE CALCULATED. THE HI FOR THE NONCARCINOGENS WERE $2 \times (10^{-4})$ (PAR) AND $1 \times (10^{-3})$ (PMR). RESULTS ARE PRESENTED IN TABLE 18.

3. AIR EMISSIONS: THE PRIMARY SOURCE OF EXPOSURE TO AIR CONTAMINANTS IS THROUGH THE DUST GENERATED OR VOLATILES RELEASED BY RIDING DIRT BIKES OR ALL-TERRAIN VEHICLES ACROSS THE SITE. RISK CALCULATIONS WERE BASED UPON THE MODEL DEVELOPED BY ICF CLEMENTS (1989). EMISSION RATES AND AIR CONCENTRATIONS ESTIMATED FROM DUST GENERATION ARE PRESENTED IN TABLE 19. THE HUMAN HEALTH RISKS ASSOCIATED WITH THIS SOURCE ARE PRESENTED IN TABLE 20. THE TOTAL LIFETIME CANCER RISKS RANGED FROM $3 \times (10^{-8})$ (PAR) TO $7 \times (10^{-7})$ (PMR). THE ADDITIONAL RISK DUE TO VOLATILIZATION OF CONTAMINATION ASSOCIATED WITH DUST PARTICLES IS MINIMAL, SINCE THE PMR ASSOCIATED WITH PCE (THE ORGANIC VOLATILE ORGANIC CONTAMINANT OF CONCERN) IS ONLY $6.6 \times (10^{-13})$.

B. FUTURE SITE USE

UNDER THIS SCENARIO IT IS ASSUMED THAT A HOUSE COULD BE PLACED ON THE SITE. THE SAME POTENTIAL POINTS OF EXPOSURE, I.E. AIR, INTERMITTENT STREAMS AND SOIL WOULD STILL EXIST, HOWEVER THE RISK ASSOCIATED WITH AIR AND SURFACE WATER WOULD BE MUCH SMALLER THAN THE RISKS ASSOCIATED WITH SOIL AND ON-SITE GROUNDWATER. SHORT-TERM EXPOSURE TO VOLATILE ORGANICS RELEASED INTO THE ATMOSPHERE COULD RESULT FROM EXCAVATION ACTIVITIES IF UNDERTAKEN IN THE CENTRAL AREA OF THE SITE. BASED UPON AIR MONITORING DURING THE SOIL AERATION PROJECT, TOTAL VOLATILE ORGANICS COULD INITIALLY BE 300 PPM ABOVE THE AERATED SOILS, BUT WOULD FALL BELOW 50 PPM WITHIN AN HOUR. OSHA'S 8-HOUR TIME WEIGHTED AVERAGE LIMITS INDIVIDUAL ORGANICS TO A RANGE OF 100 TO 350 PPM, HOWEVER, DUE TO DISPERSION, THE CONCENTRATION OF VOLATILE ORGANICS IN THE BREATHING ZONE OF CONSTRUCTION WORKERS WOULD BE CONSIDERABLY LESS THAN THESE VALUES.

1. RISKS FROM ON-SITE SOIL: THE FUTURE USE SCENARIO ASSUMED THAT A CHILD COULD DIG DOWN

APPROXIMATELY 6 INCHES AND BE EXPOSED TO CONTAMINATED SOIL. IT SHOULD BE NOTED THAT, WITH REGARD TO VOLATILE ORGANICS, AN INDIVIDUAL WOULD HAVE TO DIG DOWN IN DIFFERENT AREAS OR TO SEVERAL DIFFERENT DEPTHS IN THE SAME AREA EACH DAY TO EXPOSE FRESH SOIL SURFACES TO BE EXPOSED TO COMPOUNDS AT ELEVATED CONCENTRATIONS.

FOR ON-SITE RESIDENTS, CHILDREN'S AGES RANGED FROM 2 TO 12 YEARS OLD WITH AVERAGE AGE BEING 7 YEARS OLD. THE AVERAGE WEIGHT FOR SUCH A CHILD WAS ESTIMATED TO BE 25 KG (US EPA, 1989). THE EXPOSURE FREQUENCY RATE FOR THE PAR WAS 120 DAYS PER YEAR AND FOR THE PMR 240 DAYS PER YEAR. ADULTS WOULD BE EXPOSED FOR A DURATION OF 25 TO 50 YEARS WITH 40 TO 120 DAYS OF EXPOSURE EACH YEAR. SOIL CONTACT RATES, ABSORPTION DATA AND INCIDENTAL SOIL INGESTION RATES REMAINED THE SAME AS THOSE IN THE CURRENT USE SCENARIO. AS WITH THE CURRENT USE SCENARIO, WHEN RISK WAS RECALCULATED ASSUMING 1 PERCENT DERMAL ABSORPTION OF INORGANICS FROM SOIL, THE RISK DID NOT INCREASE SIGNIFICANTLY.

CALCULATED RISKS FOR EACH SOIL SAMPLING LOCATION ARE PRESENTED IN TABLE 21. FIGURE 30 SHOWS EACH LOCATION. THE TOTAL CANCER RISKS RANGED FROM NONE DETECTED TO $1 \times (10^{-5})$. THE AVERAGE CANCER RISK FOR THE SITE WAS CALCULATED AT $7 \times (10^{-9})$ (PAR) AND $4 \times (10^{-8})$ (PMR). THE HI FOR NONCARCINOGENS RANGED FROM 5×10^{-5} TO 2. THE AVERAGE HI FOR THE PAR AND PMR WERE $8 \times (10^{-3})$ AND $3 \times (10^{-2})$, RESPECTIVELY.

2. RISKS FROM FUTURE ON-SITE DRINKING WATER WELLS: THE RISK ASSOCIATED WITH FUTURE RESIDENTS' DRINKING WATER FROM ON-SITE WELLS WAS CALCULATED UTILIZING THE ORGANIC CHEMICALS. FOR CALCULATIONS, IT WAS ASSUMED THAT A CHILD WOULD DRINK 1 LITER PER DAY AND AN ADULT 2 LITERS PER DAY. THE EXPOSURE RATES WERE ESTIMATED AT 5 DAYS FOR 50 WEEKS PER YEAR FOR THE PAR AND 7 DAYS FOR 50 WEEKS PER YEAR FOR THE PMR.

RESULTS OF THE CALCULATIONS ARE PRESENTED IN TABLE 22. THE CALCULATED CARCINOGENIC RISK RANGED FROM $5 \times (10^{-7})$ TO $1 \times (10^{-6})$. THE TOTAL HI FOR THE NONCARCINOGENIC CHEMICALS RANGED FROM $1 \times (10^{-2})$ TO $2 \times (10^{-2})$.

ENVIRONMENTAL RISKS

LOCATIONS ON THE SITE THAT CONTAIN ELEVATED CONTAMINANT CONCENTRATIONS COULD BE HARMFUL OR JEOPARDIZE THE HEALTH OF SOME PLANT AND ANIMAL SPECIES. THE PRIMARY RISKS WOULD BE TO ANIMALS THAT BURROW INTO THE CONTAMINATED SOILS AND PLANTS WHOSE ROOT SYSTEMS EXTEND INTO THE CONTAMINATED SOILS. AT THE PRESENT TIME, ONLY SHORT ROOTED PLANTS OCCUPY THE AREAS WHERE DISPOSAL TOOK PLACE. THEIR SPARSE DISTRIBUTION ACROSS THE SITE MAY IN PART BE DUE TO THE REMOVAL OF TOP SOIL RATHER THAN THE ACTUAL CONTAMINATION.

FOR THE INORGANIC CONTAMINANTS, HEXAVALENT CHROMIUM CONCENTRATIONS OVER 240 MG/KG WOULD PRESENT THE GREATEST RISK TO BURROWING ANIMALS. THIS VALUE WAS CALCULATED FROM RAT INGESTION RATES. CONCENTRATIONS ABOVE 240 MG/KG COULD RESULT IN LOSS OF WEIGHT, INCREASED LIVER AND KIDNEY WEIGHT AND/OR DECREASED REPRODUCTION CAPACITY. EXTREMELY HIGH CONCENTRATIONS COULD RESULT IN DEATH. ONLY TWO AREAS, APPROXIMATELY 100 CUBIC YARDS OF SOIL, AT THE SITE ARE KNOWN TO CONTAIN SIGNIFICANT LEVELS OF CHROMIUM. SINCE IT IS UNLIKELY THAT AN ANIMAL WILL REMAIN ONLY IN THESE AREAS, THE RISK ASSOCIATED WITH THIS TYPE OF EXPOSURE IS LOW.

WITHIN THE CENTRAL AREA OF THE SITE, ANIMALS COULD BE EXPOSED TO THE VOLATILE ORGANICS REMAINING ON-SITE. BASED UPON STUDIES USING GUINEA PIGS, THE EXPOSURE LIMIT FOR 1,1,1-TRICHLOROETHANE WOULD BE 500 PPM. FOR TETRACHLOROETHENE, CONCENTRATIONS OF 250 MG/KG/DAY PRODUCED INCREASED LIVER WEIGHTS IN LABORATORY MICE. WHEN CONCENTRATIONS WERE INCREASED TO 1,400 MG/KG/DAY THE MICE BEGAN LOSING WEIGHT HOWEVER THEIR LIVERS INCREASED IN WEIGHT. THE CENTRAL AREA WAS FOUND TO CONTAIN TETRACHLOROETHENE BETWEEN THESE CONCENTRATIONS, THEREFORE BURROWING ANIMALS COULD SUFFER FROM IMPAIRED HEALTH.

ONLY TRACE CONTAMINANTS WERE DETECTED IN THE INTERMITTENT TRIBUTARY DRAINING TO THE ON-SITE SINKHOLE. ON-SITE STREAMS AND WATER OCCUR ONLY AFTER PRECIPITATION EVENTS, THEREFORE BIOTIC LIFE WOULD BE LIMITED TO ORGANISMS SUCH AS BACTERIA, PHYTOPLANKTON AND ZOOPLANKTON THAT HAVE VERY SHORT LIVES. THE STREAMS DO NOT EXIST LONG ENOUGH TO SUPPORT FISH SPECIES. SHALLOWNESS OF THE SEDIMENT ON THE SITE DOES NOT PROVIDE ENOUGH MOISTURE TO PREVENT DESICCATION OF AMPHIBIANS AND REPTILES. DURING SAMPLING, BOTH 1,1,1-TRICHLOROETHANE AT 0.004 MG/L AND CYANIDE AT 0.006 MG/L WERE FOUND IN THE ON-SITE WATER. NEITHER CONCENTRATION EXCEEDS THE ACUTE TOXICITY VALUE FOR 1,1,1-TRICHLOROETHANE (18 MG/L) NOR THE FREE CYANIDE VALUE OF 0.052 MG/L.

UNCERTAINTY

RISK ASSESSMENT HAS SOME INHERENT UNCERTAINTY DUE TO TOXICITY EXTRAPOLATIONS AND EXPOSURE ESTIMATIONS. A SPECIFIC UNCERTAINTY FOR THIS SITE IS THE CHROMIUM CONTAMINATED SOIL. SINCE ANALYSES WERE NOT DONE TO DETERMINE THE QUANTITY OF EACH FORM OF CHROMIUM, IT WAS ASSUMED THAT ALL THE CHROMIUM WAS IN THE MORE TOXIC FORM. ANOTHER UNCERTAINTY AROSE FROM THE EPHEMERAL NATURE OF THE ON-SITE STREAM. ONLY ONE SAMPLE COULD BE COLLECTED AND THUS THE DATA USED TO CALCULATE THE RISK FROM EXPOSURE TO THIS SURFACE WATER WERE VERY LIMITED. OVERALL, CONSERVATIVE ASSUMPTIONS WERE USED IN THE RISK ASSESSMENT IN ORDER TO EVALUATE THE WORST REASONABLE SITUATION.

HEALTH RISK SUMMARY

THE ESTIMATED AVERAGE AND MAXIMUM HEALTH RISKS ARE PRESENTED IN TABLE 23. THE AVERAGE RISKS FOR CURRENT CONDITIONS AT THE SITE ARE BELOW THE TARGET LEVEL OF 1×10^{-6} FOR CARCINOGENIC RISKS AND 1 FOR NONCARCINOGENIC RISKS. THE MAXIMUM RISKS COULD OCCUR IF AN INDIVIDUAL REPEATEDLY RETURNED TO A CONTAMINATED AREA FOR SEVERAL WEEKS A YEAR OVER A LIFETIME. WHEN CONSIDERING A FUTURE USE SCENARIO WITH RESIDENTS LIVING ON THE SITE, THE CANCER RISK ASSOCIATED WITH MAXIMUM EXPOSURE TO THE AREA WITH THE HIGHEST CONCENTRATION OF TETRACHLOROETHENE IS 1×10^{-5} . FOR AN INDIVIDUAL THAT REPEATEDLY RETURNS TO THE OUTLYING AREA WHERE THE SOIL IS MOST CONTAMINATED WITH CHROMIUM, THE ESTIMATED HI IS 2.0.

#SSR

SUMMARY OF SITE RISKS

ACTUAL OR THREATENED RELEASES OF HAZARDOUS SUBSTANCES FROM THE SITE, IF NOT ADDRESSED BY IMPLEMENTING THE RESPONSE ACTION SELECTED IN THIS ROD, MAY PRESENT AN IMMINENT AND SUBSTANTIAL ENDANGERMENT TO PUBLIC HEALTH, WELFARE, OR THE ENVIRONMENT.

#DA

DESCRIPTION OF ALTERNATIVES

THE CONTAMINATED SOILS ON-SITE ARE BEING CONSIDERED FOR CLEANUP. ALL DRUMS, WASTES, IDENTIFIED SLUDGE POCKETS AND CONTAMINATED WATER WERE REMOVED FROM THE SITE DURING 1988. THE TREATMENT ALTERNATIVES PRESENTED ARE FOR THE RESIDUAL CONTAMINANTS LEFT IN THE ON-SITE SOIL. A REMEDY HAS BEEN PROPOSED TO PROTECT PUBLIC HEALTH AND THE ENVIRONMENT BY REDUCING CONTAMINANT CONCENTRATIONS IN THE SOIL TO LEVELS THAT WILL BE PROTECTIVE OF GROUNDWATER AND REDUCE THE RISKS FROM INCIDENTAL SOIL INGESTION. THE AQUIFER UNDERLYING THE SITE WAS IDENTIFIED AS A CLASS IIA, HOWEVER IT IS NOT USED AS A DRINKING WATER SOURCE. THE DETERMINATION OF THE EXTENT OF CONTAMINATION IN THE GROUNDWATER SYSTEM UNDERNEATH THE SITE WAS HAMPERED BY THE KARST SYSTEM. OFF-SITE CONTAMINATION IN SURFACE WATER, SEDIMENTS AND GROUNDWATER, AT THE TIME OF SAMPLING, WAS WITHIN THE US EPA'S MCLS AND HEALTH-BASED LEVELS.

A TOTAL OF SIX ALTERNATIVES WERE EVALUATED IN DETAIL FOR REMEDIATING THE CONTAMINATED SOILS. EACH IS DISCUSSED IN THE FOLLOWING PARAGRAPHS.

ALTERNATIVE ONE: NO ACTION

PRESENT WORTH COST:	\$ 215,700
CAPITAL COST:	\$ 84,700
OPERATIONS & MAINTENANCE COST:	\$ 131,000
TIME TO IMPLEMENT:	6 MONTHS

CERCLA REQUIRES THAT THE NO ACTION ALTERNATIVE BE CONSIDERED AT EVERY SITE. UNDER THIS ALTERNATIVE, EIGHT WELLS WILL BE INSTALLED ON-SITE. CONFIRMATORY DYE-TRACE STUDIES WILL NEED TO BE CONDUCTED TO INSURE THAT THE WELLS ACTUALLY INTERCEPT GROUNDWATER CONDUITS. THESE WELLS, ALONG WITH BOUTWELL SPRING AND ANY OTHER SPRINGS OR WELLS THAT ARE LOCATED ALONG THE GROUNDWATER CONDUIT BETWEEN BOUTWELL SPRING AND THE SITE, WILL BE MONITORED QUARTERLY FOR A PERIOD OF THIRTY YEARS. NO SOIL REMOVAL OR TREATMENT WILL BE IMPLEMENTED. THE ONLY REDUCTION OF CONTAMINANT LEVELS WILL OCCUR VIA NATURAL PROCESSES SUCH AS DISPERSION OR DEGRADATION. THE ONLY COSTS WILL BE FOR THE INITIAL INSTALLATION OF WELLS AND QUARTERLY GROUNDWATER MONITORING.

BECAUSE THIS ALTERNATIVE WILL LEAVE CONTAMINANTS ON-SITE, CERCLA REQUIRES THAT THE SITE BE REEVALUATED EVERY FIVE YEARS. IF JUSTIFIED BY THE REVIEW, REMEDIAL ACTIONS WILL BE IMPLEMENTED AT THAT TIME TO REMOVE OR TREAT THE SOILS.

ALTERNATIVE TWO: INSTITUTIONAL CONTROLS

PRESENT WORTH COST:	\$ 307,125
CAPITAL COST:	\$ 143,350
OPERATIONS & MAINTENANCE COST:	\$ 163,775
TIME TO IMPLEMENT:	6 MONTHS

INSTITUTIONAL CONTROLS WILL INCLUDE MEASURES TO LIMIT BOTH HUMAN AND ANIMAL CONTACT WITH ON-SITE SOILS. AROUND THE PERIMETER OF THE SITE A 3,000 FOOT FENCE WILL BE CONSTRUCTED AND MAINTAINED. SIGNS THAT WARN POTENTIAL TRESPASSERS OF THE HAZARDOUS NATURE OF THE SITE WILL BE PLACED EVERY 100 FEET ALONG THE FENCE. TO LIMIT FUTURE SITE USAGE, RESTRICTIONS WILL BE RECORDED ON THE DEED FOR BOTH THE PROPERTY AND ON-SITE SURFACE AND GROUNDWATER SUPPLIES. THIS ALTERNATIVE WILL NOT INVOLVE REMOVAL OR TREATMENT OF CONTAMINATED SOILS.

COMPONENTS OF THE NO ACTION ALTERNATIVE WILL ALSO BE INCLUDED IN THIS ALTERNATIVE. EIGHT ON-SITE WELLS WILL BE INSTALLED AND MONITORED, QUARTERLY FOR 30 YEARS, ALONG WITH BOUTWELL SPRING AND ANY OTHER SPRINGS OR WELLS THAT ARE LOCATED ALONG THE GROUNDWATER CONDUIT BETWEEN BOUTWELL SPRING AND THE SITE. AGAIN, AS WITH THE NO ACTION ALTERNATIVE, CONTAMINATION WILL BE LEFT IN PLACE THEREFORE A RISK ASSESSMENT WILL BE REQUIRED EVERY FIVE YEARS.

ALTERNATIVE THREE: RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) LANDFILL CAP AND DRAINAGE SYSTEM

PRESENT WORTH COST:	\$ 839,460
CAPITAL COST:	\$ 632,100
OPERATIONS & MAINTENANCE COST:	\$ 207,630
TIME TO IMPLEMENT:	18 MONTHS

AN ON-SITE RCRA LANDFILL CAP WILL BE CONSTRUCTED OVER THE CENTRAL AREA OF THE SITE WHERE THE ORGANIC CONTAMINATED SOILS ARE LOCATED (APPROXIMATELY 1.5 ACRES). THE OUTLYING AREAS, WHICH CONTAIN THE TWO CHROMIUM CONTAMINATED LOCATIONS, WILL BE EXCAVATED AND USED AS FILL IN THE CENTRAL AREA. SINCE THE CENTRAL AREA IS SITUATED IN A BASIN, IT IS ESTIMATED THAT 10,000 CUBIC YARDS OF FILL WILL BE NEEDED TO PROVIDE A SLOPE THAT WILL PROMOTE PROPER SURFACE DRAINAGE. THE OUTLYING AREA WILL CONTRIBUTE ONLY 2,000 CUBIC YARDS OF SOIL TO THE CENTRAL AREA.

THE CAP WILL BE CONSTRUCTED OF A 2-FOOT THICK LAYER OF CLAY, A 20-MIL SYNTHETIC LINER, A 1-FOOT THICK GRAVEL DRAINAGE LAYER, A GEOTEXTILE FILTER FABRIC AND 2 FEET OF TOPSOIL. THE TWO FEET OF SOIL WILL PROTECT THE UNDERLYING STRUCTURES FROM WINTER FROST. A RUN-ON/RUN-OFF DRAINAGE COLLECTION SYSTEM WILL BE CONSTRUCTED AROUND THE PERIMETER OF THE LANDFILL TO DIVERT WATER TO THE ON-SITE SINKHOLE.

THE CAPPED AREA WILL BE SEEDED AND FENCED. SINCE CONTAMINANTS WILL BE LEFT ON-SITE, BOUTWELL SPRING AND ANY OTHER SPRINGS OR WELLS THAT ARE LOCATED ALONG THE GROUNDWATER CONDUIT BETWEEN BOUTWELL SPRING AND THE SITE, WILL BE MONITORED QUARTERLY FOR THIRTY YEARS. A RISK ASSESSMENT WILL BE CONDUCTED EVERY 5 YEARS DURING THE 30 YEARS OF MONITORING. TO LIMIT FUTURE SITE USAGE, RESTRICTIONS WILL BE RECORDED ON THE DEED FOR BOTH THE PROPERTY AND ON-SITE SURFACE AND GROUNDWATER SUPPLIES.

ALTERNATIVE FOUR: OFF-SITE RCRA LANDFILL

PRESENT WORTH COST:	\$ 3,852,000
CAPITAL COST:	\$ 3,809,375
OPERATIONS & MAINTENANCE COST:	\$ 42,625
TIME TO IMPLEMENT:	6 MONTHS

THIS ALTERNATIVE INVOLVES THE EXCAVATION AND TRANSPORTION OF CONTAMINATED SOILS TO AN OFF-SITE RCRA APPROVED LANDFILL. APPROXIMATELY 100 CUBIC YARDS OF SOIL IN THE OUTLYING AREA CONTAIN ELEVATED CONCENTRATIONS OF CHROMIUM AND APPROXIMATELY 7,400 CUBIC YARDS OF SOIL IN THE CENTRAL AREA CONTAIN ELEVATED CONCENTRATIONS OF ORGANICS. A PROPORTIONATE AMOUNT OF CLEAN FILL DIRT WILL BE BROUGHT TO THE SITE TO REPLACE THE REMOVED SOILS. THESE AREAS WOULD THEN BE SEEDED TO RESTORE THE NATURAL VEGETATIVE COVER. A RUN-ON/RUN-OFF DRAINAGE COLLECTION SYSTEM WILL BE CONSTRUCTED TO DIVERT WATER AWAY FROM THE AREAS OF ACTIVITY.

EXCAVATED SOILS WILL BE STOCKPILED IN A LOCATION THAT FACILITATES LOADING INTO TRANSPORT VEHICLES. A CRUSHED ROCK ROAD WILL BE CONSTRUCTED ACROSS THE SITE SO THAT TRUCKS CAN ACCESS THE STOCKPILE. APPROXIMATELY 500 CUBIC YARDS OF MATERIAL WILL BE HAULED OFF THE SITE EACH DAY. BOTH THE EXCAVATED AREAS AND ROADWAYS WILL BE WETTED TO CONTROL DUST.

ALTHOUGH THE CONTAMINATED SOIL WILL BE REMOVED FROM THE SITE, THERE IS A POSSIBILITY THAT SOME RESIDUAL CONTAMINATION MAY BE CONTAINED IN THE UNDERLYING KARST SYSTEM. CHANGES IN THE KARST CONDUITS COULD EXPOSE GROUNDWATER TO THESE CONTAMINANTS. TO ELIMINATE THE POSSIBILITY THAT TRAPPED CONTAMINATION MAY MIGRATE OFF-SITE UNDETECTED, QUARTERLY MONITORING OF BOUTWELL SPRING AND ANY OTHER SPRINGS OR WELLS THAT LIE ALONG THE ROUTE BETWEEN BOUTWELL SPRING AND THE SITE WILL BE CONDUCTED FOR FIVE YEARS. A RISK ASSESSMENT WILL ALSO BE CONDUCTED AT THE END OF THE FIVE YEAR PERIOD. TO LIMIT FUTURE SITE USAGE, RESTRICTIONS WILL BE RECORDED ON THE DEED FOR BOTH THE PROPERTY AND ON-SITE SURFACE AND GROUNDWATER SUPPLIES.

ALTERNATIVE FIVE: OFF-SITE DISPOSAL AND ON-SITE AERATION

PRESENT WORTH COST:	\$ 394,525
CAPITAL COST:	\$ 351,900
OPERATIONS & MAINTENANCE COST:	\$ 42,625
TIME TO IMPLEMENT:	6 MONTHS

OUTLYING SOIL, APPROXIMATELY 100 CUBIC YARDS, CONTAINING ELEVATED CHROMIUM CONCENTRATIONS WILL BE EXCAVATED AND TRANSPORTED TO AN OFF-SITE RCRA APPROVED LANDFILL. ASSUMING A TYPICAL TRUCK CAN TRANSPORT ONLY 20 CUBIC YARDS, THEN THE REMOVAL WILL REQUIRE APPROXIMATELY FIVE TRUCKLOADS. EXCAVATED SOIL WILL THEN BE REPLACED WITH CLEAN FILL DIRT.

AN INITIAL BENCH SCALE TREATABILITY STUDY WILL BE CONDUCTED TO DETERMINE IF AERATION WILL EFFECTIVELY REDUCE CONTAMINATION TO LEVELS THAT ARE PROTECTIVE OF HUMAN HEALTH AND THE GROUNDWATER. ONCE THE TREATABILITY STUDY INDICATES THAT THE PROCESS WILL EFFECTIVELY REDUCE ORGANICS THEN A FULL SCALE PROJECT WILL BEGIN.

BASED UPON THE SOIL AERATION PREVIOUSLY CONDUCTED AT THE SITE, IT IS EXPECTED THAT THE CENTRAL AREA SOILS WILL BE EXCAVATED AND PLACED NEXT TO THEIR UNEARTHED TRENCHES IN 1-FOOT HIGH LIFT. THE SOIL WILL BE MECHANICALLY MIXED TO BREAK UP DIRT CLUMPS AND PROMOTE VOLATILIZATION OF THE ORGANICS. PERIODIC SAMPLING OF SOIL, USING THE US EPA REGION IV STANDARD OPERATING PROCEDURES, WILL BE CONDUCTED TO ENSURE THAT CLEAN-UP CRITERIA ARE BEING MET.

ADDITIONALLY, AIR MONITORING FOR PARTICULATES AND VOLATILE ORGANICS WILL BE CONDUCTED ALONG THE SITE BOUNDARY. PRIOR TO AERATION ACTIVITIES, A RUN-ON/RUN-OFF COLLECTION SYSTEM WILL BE CONSTRUCTED TO DIVERT WATER AWAY FROM THE AERATING SOILS. ONCE ORGANIC CONTAMINANT CONCENTRATIONS ARE DETERMINED THROUGH LABORATORY ANALYSIS TO BE WITHIN THE ACCEPTABLE SOIL ACTION CONCENTRATIONS, THE REMEDIATED SOIL WILL BE REDEPOSITED IN THE CENTRAL AREA. UPON COMPLETION, THE SITE WILL BE REGRADED, COVERED WITH TOPSOIL AND SEEDED TO RESTORE THE VEGETATIVE COVER.

AS WITH ALTERNATIVE 4, THIS ALTERNATIVE 5 WILL REQUIRE QUARTERLY MONITORING OF BOUTWELL SPRING AND ANY OTHER SPRINGS OR WELLS THAT LIE ALONG THE ROUTE BETWEEN BOUTWELL SPRING AND THE SITE FOR A PERIOD OF FIVE YEARS. A RISK ASSESSMENT WILL ALSO BE CONDUCTED AT THE END OF THE FIVE YEAR PERIOD. TO LIMIT FUTURE SITE USAGE, RESTRICTIONS WILL BE RECORDED ON THE DEED FOR BOTH THE PROPERTY AND ON-SITE SURFACE AND GROUNDWATER SUPPLIES.

ALTERNATIVE SIX: OFF-SITE INCINERATION

PRESENT WORTH COST:	\$ 19,001,800
CAPITAL COST:	\$ 18,989,400
OPERATIONS & MAINTENANCE COST:	\$ 12,400
TIME TO IMPLEMENT:	6 MONTHS

APPROXIMATELY 7,500 CUBIC YARDS OF CONTAMINATED SOILS, FROM BOTH THE OUTER AND CENTRAL AREAS, WILL BE EXCAVATED AND TRANSPORTED TO A RCRA APPROVED INCINERATOR. THE INCINERATOR WILL DESTROY THE ORGANIC CONTAMINANTS, HOWEVER RESIDUAL ASH WILL STILL CONTAIN INORGANICS AND WILL BE DISPOSED OF IN A RCRA APPROVED OFF-SITE LANDFILL.

AS SPECIFIED IN ALTERNATIVE 4, THE SOILS WILL BE STOCKPILED IN AN AREA THAT IS ACCESSABLE TO TRANSPORTATION VEHICLES. A GRAVEL ROAD WILL BE CONSTRUCTED ON-SITE TO FACILITATE THE REMOVAL ACTIVITIES. DURING EXCAVATION ACTIVITIES, RUN-ON/RUN-OFF WATER CONTROLS WILL BE IMPLEMENTED TO DIVERT WATER. SOILS AND ROADWAYS WILL BE WETTED TO CONTROL DUST.

CLEAN FILL DIRT WILL BE USED TO REPLACE THE REMOVED SOIL. SEEDING OF THE SITE WILL RESTORE THE NATURAL VEGETATIVE COVER.

AGAIN, QUARTERLY MONITORING OF BOUTWELL SPRING AND ANY OTHER SPRINGS OR WELLS THAT LIE ALONG THE ROUTE BETWEEN BOUTWELL SPRING AND THE SITE WILL BE CONDUCTED FOR FIVE YEARS. A RISK ASSESSMENT WILL ALSO BE CONDUCTED AT THE END OF THE FIVE YEAR PERIOD. TO LIMIT FUTURE SITE USAGE, RESTRICTIONS WILL BE RECORDED ON THE DEED FOR BOTH THE PROPERTY AND ON-SITE SURFACE AND GROUNDWATER SUPPLIES.

#ARAR

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)

SECTION 131(D) OF CERCLA, AS AMENDED BY SARA, IDENTIFIES THE FOLLOWING THREE CATEGORIES OF ARARS: CONTAINMENT-SPECIFIC, LOCATION-SPECIFIC AND ACTION-SPECIFIC. LOCATION-SPECIFIC ARARS DO NOT APPLY TO THIS SITE SINCE IT IS NOT WITHIN A 100-YEAR FLOODPLAIN, CONTAINS NO WETLANDS OR CRITICAL WILDLIFE HABITATS, AND DOES NOT POSSESS REGISTERED HISTORICAL OR ARCHEOLOGICAL SITES.

ACTION-SPECIFIC ARARS

ACTION-SPECIFIC ARARS ARE THOSE DIRECTED TOWARDS SITE OPERATIONS SUCH AS HANDLING, STORAGE, TREATMENT, TRANSPORTATION AND/OR DISPOSAL OF CONTAMINATED WASTES OR MATERIALS. THE FOLLOWING ACTION-SPECIFIC ARARS WERE DELINEATED FOR THE SITE:

FEDERAL

- RCRA HAZARDOUS WASTE REQUIREMENTS
TREATMENT, STORAGE AND DISPOSAL REGS 40 CFR 264 AND 265
LAND DISPOSAL REGS 40 CFR 268
- CLEAN WATER ACT PL 92-500
NPDES 40 CFR 122 - 129
- CLEAN AIR ACT
NAAQS 40 CFR 51
PSD 40 CFR 52
- OSHA REQUIREMENTS
WORKERS 29 CFR 1910 AND 1926
- DOT REGULATIONS
TRANSPORTATION 40 CFR 171 - 177
- EPA'S GROUNDWATER PROTECTION
STRATEGY

STATE OF KENTUCKY

- SOLID/HAZARDOUS WASTE REQUIREMENTS
REPORTING AND STANDARDS 401 KAR 32, 34 AND 35
- AIR QUALITY
FUGITIVE EMISSIONS/OPEN BURNING 401 KAR 63
- WATER
DISCHARGE OF WASTES 401 KAR 5
- OCCUPATIONAL SAFETY AND HEALTH
WORKERS 803 KAR 2
- TRANSPORTATION
PERMITS/HANDLING PROCEDURES 601 KAR 1

CONTAMINANT-SPECIFIC ARARS

CONTAMINANT-SPECIFIC ARARS SET MEDIA CONCENTRATION LIMITS FOR SPECIFIC CONTAMINANTS. THEY INCLUDE THE FOLLOWING REGULATIONS AND/OR GUIDANCE:

FEDERAL

- SAFE DRINKING WATER ACT
MCLS AND MCLGS 40 CFR 141 - 143
- CLEAN WATER ACT
QUALITY CRITERIA SECTION 304(A)(1)
- CLEAN AIR ACT
NAAQS 40 CFR 50
- OSHA
AIR CONTAMINANTS: 8-HOUR TIME
WEIGHTED AVERAGES (TWAS) 29 CFR 1900

STATE

- WATER
SURFACE WATER STANDARDS 401 KAR 5
- AIR
AMBIENT AIR QUALITY STANDARDS 401 KAR 53
TOXIC EMISSIONS 401 KAR 63

PRESENTLY, WITH THE EXCEPTION OF THE LAND DISPOSAL REGULATIONS, THERE ARE NO CONTAMINANT-SPECIFIC ARARS FOR VOLATILE ORGANIC COMPOUNDS IN SOIL. SINCE CONTAMINANTS IN THE ON-SITE SOILS POSE A POTENTIAL RISK TO GROUNDWATER RESOURCES, HEALTH BASED ACTION LEVELS HAD TO BE CALCULATED FROM DATA COLLECTED DURING THE SAMPLING ACTIVITIES. THE SPECIFIC METHODOLOGIES FOR ESTABLISHING THE SALS WERE OUTLINED IN APPENDIX C OF THE JULY 1990 RI REPORT. THE CALCULATED SALS FOR THE SITE-SPECIFIC VOLATILE ORGANIC COMPOUNDS OF INTEREST WERE:

1, 2-DICHLOROETHENE	7.72 MG/KG
1,1,1-TRICHLOROETHANE	117.30 MG/KG
TETRACHLOROETHENE	GT 7.50 MG/KG

FOR THE INORGANIC CHEMICALS OF INTEREST, HEALTH-BASED CLEANUP LEVELS WERE ESTABLISHED BY BACK-CALCULATING SOIL INGESTION RISKS TO A HAZARD INDEX OF (1) FOR EACH CHEMICAL. UTILIZING A 16 KG (35 POUND) CHILD INGESTING 200 MG/DAY OF CONTAMINATED SOIL FOR 365 DAYS/YEAR, THE FOLLOWING SALS WERE CALCULATED:

COPPER	2,300 MG/KG
CHROMIUM (VI)	400 MG/KG
ZINC	16,000 MG/KG
CYANIDE	1,600 MG/KG

#SCAA

SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

THE REMEDIAL ALTERNATIVES DEVELOPED DURING THE HOWE VALLEY LANDFILL SITE FS WERE EVALUATED BY THE US EPA USING THE FOLLOWING NINE CRITERIA. THE ADVANTAGES AND DISADVANTAGES OF EACH ALTERNATIVE WERE THEN COMPARED TO IDENTIFY THE ALTERNATIVE PROVIDING THE BEST BALANCE AMONG THESE NINE CRITERIA.

1. OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT ADDRESSES WHETHER OR NOT AN ALTERNATIVE PROVIDES ADEQUATE PROTECTION AND DESCRIBES HOW RISKS ARE ELIMINATED, REDUCED OR CONTROLLED THROUGH TREATMENT AND ENGINEERING OR INSTITUTIONAL CONTROLS.

2. COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) ADDRESSES WHETHER OR NOT AN ALTERNATIVE WILL MEET ALL OF THE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS OR PROVIDE GROUNDS FOR INVOKING A WAIVER.
3. LONG-TERM EFFECTIVENESS AND PERMANENCE REFERS TO THE ABILITY OF AN ALTERNATIVE TO MAINTAIN RELIABLE PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT, OVER TIME, ONCE CLEANUP OBJECTIVES HAVE BEEN MET.
4. REDUCTION OF TOXICITY, MOBILITY OR VOLUME IS THE ANTICIPATED PERFORMANCE OF THE TREATMENT TECHNOLOGIES AN ALTERNATIVE MAY EMPLOY.
5. SHORT-TERM EFFECTIVENESS INVOLVES THE PERIOD OF TIME NEEDED TO ACHIEVE PROTECTION AND ANY ADVERSE IMPACTS ON HUMAN HEALTH AND THE ENVIRONMENT THAT MAY BE POSED DURING THE CONSTRUCTION AND IMPLEMENTATION PERIOD UNTIL CLEANUP OBJECTIVES ARE ACHIEVED.
6. IMPLEMENTABILITY IS THE TECHNICAL AND ADMINISTRATIVE FEASIBILITY OF AN ALTERNATIVE, INCLUDING THE AVAILABILITY OF GOODS AND SERVICES NEEDED TO IMPLEMENT THE SOLUTION.
7. COST INCLUDES CAPITAL COSTS, AS WELL AS OPERATION AND MAINTENANCE COSTS.
8. AGENCY ACCEPTANCE INDICATES WHETHER, BASED ON ITS REVIEW OF THE RI/FS AND PROPOSED PLAN, THE COMMONWEALTH OF KENTUCKY AGREES ON THE PREFERRED ALTERNATIVES.
9. COMMUNITY ACCEPTANCE INDICATES THE PUBLIC SUPPORT OF A GIVEN ALTERNATIVE. THIS CRITERIA IS DISCUSSED IN THE RESPONSIVENESS SUMMARY.

ANALYSIS

THE FOLLOWING IS THE NINE CRITERIA EVALUATION FOR THE SIX ALTERNATIVES. THE ANALYSIS ASSUMES THAT ANY UNCERTAINTIES ASSOCIATED WITH ALTERNATIVE 5 WILL BE ELIMINATED THROUGH THE SUCCESS OF THE TREATABILITY STUDY.

OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

ALL ALTERNATIVES PRESENTED IN THIS DOCUMENT, WITH THE EXCEPTION OF THE NO ACTION ALTERNATIVE, ARE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT. THE NO ACTION ALTERNATIVE WILL ALLOW HUMANS, PLANTS AND/OR ANIMALS TO BE EXPOSED TO CONTAMINANTS THROUGH CONTACT WITH ON-SITE SOIL, GROUNDWATER, SURFACE WATER, DUST PARTICLES OR CONTAMINANTS RELEASED INTO THE AIR. ALTERNATIVES 2 AND 3 WILL PREVENT ON-SITE EXPOSURE, HOWEVER, LIKE ALTERNATIVE 1, THEY WILL NOT REMOVE CONTAMINATED SOILS FROM THE SITE THEREBY ALLOWING THE POSSIBLE OFF-SITE MIGRATION OF CONTAMINANTS WHICH COULD CREATE AN INCREASED RISK TO HUMAN HEALTH. ALTERNATIVES 4, 5 AND 6 WILL ELIMINATE EXPOSURE OF HUMANS, PLANTS AND/OR ANIMALS TO ON-SITE CONTAMINANTS AND WILL PREVENT CONTAMINANT CONCENTRATIONS FROM ENTERING THE GROUNDWATER.

#CARAR

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

ALTERNATIVES 4, 5, AND 6 WILL COMPLY WITH ALL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS). ALTERNATIVES 1, 2 AND 3 WILL ALLOW CONTAMINANTS TO REMAIN ON-SITE AT CONCENTRATIONS ABOVE ACCEPTABLE LEVELS WHICH VIOLATES ARARS SPECIFIED IN THE JULY 1990 RI REPORT. HOWEVER, UNDER ALTERNATIVE 3 THE CONTAMINATED SOILS WILL BE CAPPED.

REDUCTION OF TOXICITY, MOBILITY, OR VOLUME

ALTERNATIVES 4, 5, AND 6 WILL RESULT IN A SIGNIFICANT REDUCTION IN THE TOXICITY, MOBILITY, AND VOLUME OF SOIL CONTAMINATION BY REMOVING IT FROM THE SITE OR BY TREATING IT ON-SITE. INDIRECTLY, A REDUCTION IN THE MOBILITY OF CONTAMINANTS WILL OCCUR FOR ALTERNATIVE 3 DUE TO THE LANDFILL CAP REDUCING THE AMOUNT OF WATER FILTERING THROUGH THE SOILS AND/OR FLOWING OFF-SITE. ALTERNATIVES 1 AND 2 WILL NOT PREVENT OR REDUCE THE POSSIBILITY OF CONTAMINANTS MIGRATING INTO THE GROUNDWATER, NOR WILL THEY REDUCE CONTAMINANT TOXICITY OR MOBILITY.

LONG-TERM EFFECTIVENESS AND PERMANENCE

ALTERNATIVE 4, 5 AND 6 WILL PROVIDE THE GREATEST LONG-TERM EFFECTIVENESS BY REMOVING AND/OR TREATING THE CONTAMINATED SOILS. ALTERNATIVE 4 IS SLIGHTLY LESS EFFECTIVE SINCE THE SOILS WILL NOT BE TREATED, BUT RATHER SENT OFF-SITE TO A RCRA LANDFILL. ALTERNATIVE 3 HAS A LOWER LONG-TERM EFFECTIVENESS PRIMARILY DUE TO THE UNRELIABLE NATURE OF THE KARST TERRAIN. ALTERNATIVES 1 AND 2 PROVIDE THE LOWEST LONG-TERM EFFECTIVENESS.

SHORT-TERM EFFECTIVENESS

ALTERNATIVES 1 AND 2 INVOLVE ONLY A MINIMUM AMOUNT OF CONSTRUCTION THAT COULD INCREASE THE SHORT-TERM EXPOSURE RISKS FOR ON-SITE WORKERS, NEARBY RESIDENTS OR THE SURROUNDING ENVIRONMENT. ALTERNATIVES 3, 4, 5 AND 6 MAY PRODUCE DUST FROM EITHER THE REMOVAL OR TREATMENT ACTIVITIES, HOWEVER ANY RISKS WILL BE MITIGATED THROUGH IMPLEMENTATION OF A HEALTH AND SAFETY PLAN. IN ADDITION, ALTERNATIVES 3, 4 AND 6 WILL CAUSE A TEMPORARY INCREASE IN TRUCK TRAFFIC THROUGH THE NEARBY COMMUNITY. UNDER ALTERNATIVE 5, ON-SITE WORKERS COULD BE EXPOSED TO VOLATILIZED CONTAMINANTS. THE PREVENTION OF EXCESS EXPOSURE THROUGH INHALATION OF OR CONTACT WITH THE ORGANICS WILL ALSO BE ADDRESSED IN THE HEALTH AND SAFETY PLAN. ALTERNATIVE 3 PROVIDES THE LEAST SHORT-TERM EFFECTIVENESS SINCE IT WILL TAKE THE LONGEST TO IMPLEMENT.

IMPLEMENTABILITY

THE IMPLEMENTABILITY OF AN ALTERNATIVE IS BASED ON TECHNICAL FEASIBILITY, ADMINISTRATIVE FEASIBILITY AND AVAILABILITY OF SERVICES AND MATERIALS. EACH OF THE DISCUSSED ALTERNATIVES WILL REQUIRE SOME CONSTRUCTION, SUCH AS THE INSTALLATION OF MONITORING WELLS, SECURITY FENCES, DRAINAGE COLLECTION SYSTEMS, LANDFILL CAPS OR THE REPLACEMENT OF EXCAVATED SOIL.

ALTERNATIVES 1 AND 2 WILL BE EXTREMELY DIFFICULT TO IMPLEMENT BECAUSE OF THE KARST CONDITIONS THAT OCCUR BENEATH THE SITE. TO ENSURE THAT A MONITORING WELL ACTUALLY INTERCEPTS A CONDUIT THAT CONTAINS GROUNDWATER ASSOCIATED WITH THE SITE, ADDITIONAL DYE-TRACE STUDIES WILL BE REQUIRED. SHOULD A MONITORING WELL BE INSTALLED IN THE WRONG PLACE, IT WILL BE REMOVED AND RELOCATED. THIS PROCESS MAY CONTINUE INDEFINITELY UNTIL ALL MONITORING WELLS ARE INSTALLED IN THE PROPER LOCATIONS. THE ADDITIONAL REQUIREMENTS OF ALTERNATIVE 2 (I.E. INSTALLATION OF A PERIMETER FENCE AND DEED RESTRICTIONS) WILL BE MUCH SIMPLER TO IMPLEMENT. THE ONLY PROBLEM MAY BE IN OBTAINING THE NECESSARY EQUIPMENT AND MATERIALS.

ALTERNATIVE 3 WILL REQUIRE A SUBSTANTIAL AMOUNT OF CONSTRUCTION MATERIAL, EQUIPMENT AND MANPOWER. BECAUSE THE KARST AREA PRESENTS THE OPPORTUNITY FOR SINKHOLES TO DEVELOP, THE STRUCTURAL INTEGRITY OF THE CAP COULD BE COMPROMISED THEREBY REDUCING THE EFFECTIVENESS OF THIS ALTERNATIVE.

PART OF THE REMEDY FOR ALTERNATIVE 5 WILL REQUIRE THE CONSTRUCTION OF A SOIL DRYING AND AERATION SYSTEM. ONCE CONSTRUCTED, THE PROCESS WILL BE SIMPLE TO OPERATE AND MAINTAIN. THIS ALTERNATIVE WILL ALSO REQUIRE EXCAVATION EQUIPMENT, TRANSPORT VEHICLES AND SUITABLE BACKFILL MATERIAL. THE SAME ITEMS WILL ALSO BE NEEDED FOR ALTERNATIVES 4 AND 6. FOR SUCH REMEDIES, THE IMPLEMENTABILITY WILL BE LIMITED BY THE AVAILABILITY OF THESE ITEMS AND THE ABILITY OF THE RCRA LANDFILL AND INCINERATOR TO ACCEPT THE SOILS.

COST

THE ESTIMATED PRESENT WORTH VALUE OF EACH ALTERNATIVE AND OPTION IS AS FOLLOWS:

ALTERNATIVE 1	\$	215,700
ALTERNATIVE 2	\$	307,125
ALTERNATIVE 3	\$	839,460
ALTERNATIVE 4	\$	3,852,000
ALTERNATIVE 5	\$	394,525
ALTERNATIVE 6	\$	19,001,800

SINCE CONTAMINANTS WILL REMAIN ON-SITE UNDER ALTERNATIVES 1, 2 AND 3, THEIR PWCS INCLUDE 30 YEARS OF OPERATIONS & MAINTENANCE (O&M) WITH A RISK ASSESSMENT CONDUCTED EVERY 5 YEARS. THE PWC OF ALTERNATIVES 4, 5, AND 6 INCLUDE THE COSTS FOR IMPLEMENTING 5 YEARS OF O&M WHICH INCLUDE DEED RESTRICTIONS AND QUARTERLY GROUNDWATER MONITORING. ALSO, ALTERNATIVES 4, 5, AND 6 ARE SENSITIVE TO CHANGES IN THE VOLUME OF CONTAMINATED SOIL TO BE HANDLED. CONSEQUENTLY, THEIR CAPITAL COST COULD VARY SIGNIFICANTLY ONCE THE EXTENT OF SOILS TO BE REMOVED OR TREATED IS DEFINED IN THE REMEDIAL DESIGN (RD) PHASE.

STATE ACCEPTANCE

THE KNREPC HAS REVIEWED AND SUPPLIED COMMENTS TO EPA REGARDING ALL REPORTS AND DATA PRODUCED DURING THE RI AND FS. AT THIS TIME, THE KNREPC IS OF THE OPINION THAT THE KRS 224.877 IS AN ARAR. THE US EPA, HOWEVER, DOES NOT AGREE THAT KRS 224.877 IS AN ARAR. NONETHELESS, THE US EPA HAS CAREFULLY CONSIDERED THE RISKS ASSOCIATED WITH THE ON-SITE CONTAMINATION AND FEELS THAT BOTH THE PRIMARY AND THE CONTINGENCY ALTERNATIVES WILL MEET THE REQUIREMENTS SET FORTH IN KRS 224.877 AND WILL BE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT AT A REASONABLE COST. THE CONCERNS RAISED BY THE STATE ARE DISCUSSED IN THE RESPONSIVENESS SUMMARY CONTAINED IN APPENDIX A.

COMMUNITY ACCEPTANCE

COMMUNITY ACCEPTANCE OF THE VARIOUS ALTERNATIVES IS EVALUATED IN THE RESPONSIVENESS SUMMARY CONTAINED IN APPENDIX A. THE RESPONSIVENESS SUMMARY PROVIDES A THOROUGH REVIEW OF THE COMMENTS RECEIVED ON THE RI/FS REPORTS AND THE PROPOSED PLAN DURING BOTH THE PUBLIC MEETING AND PUBLIC COMMENT PERIOD.

THE PUBLIC COMMENTS RECEIVED BY THE US EPA DURING THE PUBLIC MEETING AND PUBLIC COMMENT PERIOD SUPPORT THE US EPA'S PROPOSED PLAN OF REMEDIATION. THE LOCAL COMMUNITY AND PRPS AGREE THAT REMOVAL, COMBINED WITH ON-SITE TREATMENT OF SOILS IS THE MOST EFFECTIVE ALTERNATIVE FOR PROTECTING HUMAN HEALTH AND THE ENVIRONMENT.

THE PREFERRED ALTERNATIVES

THE PRIMARY ALTERNATIVE AND CONTINGENCY ALTERNATIVE - ALTERNATIVE 5 AND ALTERNATIVE 4, RESPECTIVELY- INVOLVE THE REMOVAL AND OFF-SITE DISPOSAL OF ON-SITE CONTAMINATED SOILS. ALTERNATIVE 5 ALSO INCLUDES ON-SITE REMEDIATION, BY AERATION, OF ORGANIC CONTAMINATED SOILS IN THE CENTRAL AREA OF THE SITE. ALTERNATIVE 4 WILL BE IMPLEMENTED IF THE TREATABILITY STUDY IN ALTERNATIVE 5 INDICATES THAT AERATION WILL NOT EFFECTIVELY REDUCE CONTAMINATION TO LEVELS THAT ARE PROTECTIVE OF GROUNDWATER AND ELIMINATE THE RISK FROM INGESTION OF CONTAMINATED SOILS.

BOTH ALTERNATIVES INCLUDE A 5 YEAR GROUNDWATER MONITORING PROGRAM ALONG WITH DEED RESTRICTIONS TO LIMIT FUTURE SITE USAGE. GROUNDWATER ASSOCIATED WITH THE SITE WILL BE MONITORED AT BOUTWELL SPRING AND ANY OTHER WELLS OR SPRINGS THAT LIE BETWEEN BOUTWELL SPRING AND THE SITE. QUARTERLY SAMPLES WILL BE COLLECTED ANNUALLY FOR FIVE YEARS. AT LEAST ONE SET OF QUARTERLY SAMPLES, PER

YEAR, WILL BE COLLECTED DURING A HIGH FLOW EVENT. SHOULD CONTAMINATION IN EITHER THE ON-SITE SOILS OR THE GROUNDWATER BE DETECTED ABOVE ACCEPTABLE LEVELS AND/OR DRINKING WATER STANDARDS, THEN THE US EPA WILL REEVALUATE THE EFFECTIVENESS OF THE ALTERNATIVES.

ALTERNATIVE 5 WILL INVOLVE THE FOLLOWING SPECIFIC ACTIVITIES:

- EXCAVATION AND OFF-SITE DISPOSAL OF APPROXIMATELY 100 CUBIC YARDS OF OUTLYING SOILS THAT CONTAIN ELEVATED CONCENTRATIONS OF INORGANICS,
- REPLACEMENT OF REMOVED SOILS WITH CLEAN FILL DIRT,
- IMPLEMENTATION OF A BENCH-SCALE TREATABILITY STUDY TO INSURE THAT THE AERATION PROCESS WILL REDUCE ORGANIC CONCENTRATIONS TO ACCEPTABLE LEVELS,
- EXCAVATION AND TREATMENT, VIA ON-SITE AERATION, OF APPROXIMATELY 7,400 CUBIC YARDS OF CENTRAL AREA SOILS THAT CONTAIN ELEVATED CONCENTRATIONS OF ORGANICS,
- ON-SITE AIR MONITORING TO INSURE ADEQUATE PROTECTION OF WORKERS AND NEARBY RESIDENTS,
- INSTALLATION OF WATER DIVERSION DITCHES TO PREVENT WATER FROM RUNNING ONTO THE AERATING SOILS,
- VEGETATION OF THE SITE TO RESTORE ITS NATURAL CONDITIONS,
- FIVE YEARS OF QUARTERLY MONITORING OF BOUTWELL SPRING AND ADDITIONAL SPRINGS OR WELLS THAT LAY ALONG THE GROUNDWATER CONDUIT BETWEEN BOUTWELL SPRING AND THE SITE; AND
- PLACEMENT OF RESTRICTIONS ON THE DEED TO LIMIT THE USAGE OF THE PROPERTY AND ITS ASSOCIATED GROUNDWATER.

ALTERNATIVE 4, IF IMPLEMENTED, WOULD INVOLVE THE FOLLOWING:

- EXCAVATION AND OFF-SITE DISPOSAL OF APPROXIMATELY 7,500 CUBIC YARDS OF SOIL FROM BOTH THE OUTLYING AND CENTRAL AREAS THAT CONTAIN ELEVATED CONCENTRATIONS OF INORGANICS AND ORGANICS, RESPECTIVELY,
- REPLACEMENT OF REMOVED SOILS WITH CLEAN FILL DIRT,
- ON-SITE AIR MONITORING TO ENSURE ADEQUATE PROTECTION OF WORKERS AND NEARBY RESIDENTS DURING EXCAVATION ACTIVITIES,
- INSTALLATION OF WATER DIVERSION DITCHES TO PREVENT WATER FROM RUNNING ONTO THE AREAS OF ACTIVITY,
- VEGETATION OF THE SITE TO RESTORE ITS NATURAL CONDITIONS,
- FIVE YEARS OF QUARTERLY MONITORING OF BOUTWELL SPRING AND ADDITIONAL SPRINGS OR WELLS THAT LAY ALONG THE GROUNDWATER CONDUIT BETWEEN BOUTWELL SPRING AND THE SITE; AND
- PLACEMENT OF RESTRICTIONS ON THE DEED TO LIMIT THE USAGE OF THE PROPERTY AND ITS ASSOCIATED GROUNDWATER.

#SD

STATUTORY DETERMINATIONS

UNDER ITS LEGAL AUTHORITIES, THE US EPA'S PRIMARY RESPONSIBILITY AT SUPERFUND SITES IS TO UNDERTAKE REMEDIAL ACTIONS THAT ACHIEVE ADEQUATE PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT. IN ADDITION, SECTION 121 OF CERCLA ESTABLISHES SEVERAL OTHER STATUTORY REQUIREMENTS AND PREFERENCES. ONE OF THE REQUIREMENTS SPECIFIES THAT WHEN COMPLETE, THE SELECTED REMEDIAL ACTION FOR THIS SITE MUST COMPLY WITH APPLICABLE OR RELEVANT AND APPROPRIATE ENVIRONMENTAL STANDARDS ESTABLISHED UNDER FEDERAL AND STATE ENVIRONMENTAL LAWS UNLESS A STATUTORY WAIVER IS JUSTIFIED. THE SELECTED REMEDY ALSO MUST BE COST EFFECTIVE AND UTILIZE PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES OR RESOURCE RECOVERY TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE. FINALLY, THE STATUTE INCLUDES A PREFERENCE FOR REMEDIES THAT EMPLOY TREATMENT THAT PERMANENTLY AND SIGNIFICANTLY REDUCE THE VOLUME, TOXICITY, OR MOBILITY OF HAZARDOUS WASTES AS THEIR PRINCIPAL ELEMENT. THE FOLLOWING SECTIONS DISCUSS HOW THE SELECTED REMEDIES MEET THESE STATUTORY REQUIREMENTS.

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

BASED UPON THE SITE RISK ASSESSMENT, LONG-TERM EXPOSURE TO CONTAMINANTS IN THE ON-SITE SOILS, PRIMARILY THE THREE LOCATIONS WHERE CHROMIUM AND TETRACHLOROETHENE WERE FOUND ABOVE THE SALS, IS THE PRINCIPAL THREAT ASSOCIATED WITH THE SITE. THIS RISK LEVEL WAS BASED ON FUTURE CONDITIONS SHOULD A RESIDENCE BE BUILT ON-SITE OR THE SURFACE SOIL INGESTED.

THE AERATION OF SOILS CONTAINING VOLATILE ORGANICS AND THE REMOVAL OF SOILS CONTAINING INORGANIC CONTAMINANTS PROTECTS HUMAN HEALTH AND THE ENVIRONMENT BY REDUCING AND/OR ELIMINATING THE LEVELS OF CONTAMINANTS TO WHICH ANIMALS, PLANTS OR HUMANS MIGHT BE EXPOSED. THE CANCER RISK ASSOCIATED WITH THE FUTURE USE AT THE SITE WILL BE REDUCED TO APPROXIMATELY 1×10^{-6} AND THE HAZARD INDICES (HI) RATION WILL BE LESS THAN 1. FOR THE SECONDARY THREAT, AERATION OF SOIL TO SALS WILL ENSURE THAT GROUNDWATER BENEATH THE SITE IS PROTECTED TO MCLS FOR THE ORGANIC CONTAMINANTS OF CONCERN.

THE SELECTED PRIMARY AND CONTINGENT REMEDIES WILL NOT POSE UNACCEPTABLE SHORT-TERM RISKS OR CROSS-MEDIA IMPACTS.

COMPLIANCE WITH ARARS

THE SELECTED REMEDIES OF OFF-SITE REMOVAL AND ON-SITE AERATION OR COMPLETE OFF-SITE REMOVAL FOR THE CONTAMINATED SOILS WILL COMPLY WITH ALL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS). ALL ARARS WERE PREVIOUSLY PRESENTED IN THE DISCUSSION OF THE NINE CRITERIA.

COST EFFECTIVENESS

THE SELECTED REMEDIES ARE COST-EFFECTIVE BECAUSE THEY HAVE BEEN DETERMINED TO PROVIDE OVERALL EFFECTIVENESS PROPORTIONAL TO THEIR COSTS. ALTERNATIVE 5 IS THE LEAST COSTLY OF ALTERNATIVES 4, 5 AND 6 WHICH MEET ALL ARARS AND ARE EQUALLY PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT. ALTERNATIVE 4, THE CONTINGENCY ALTERNATIVE, IS THE SECOND MOST COST EFFECTIVE OF THE REMEDIES THAT MEET ARARS AND PROTECTION GUIDELINES.

UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES OR RESOURCE RECOVERY TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

THE US EPA BELIEVES THE SELECTED REMEDY REPRESENTS THE MAXIMUM EXTENT TO WHICH PERMANENT SOLUTIONS AND TREATMENT TECHNOLOGIES CAN BE UTILIZED IN A COST-EFFECTIVE MANNER FOR THE FINAL REMEDIATION OF THE HOWE VALLEY LANDFILL SITE. OF THE ALTERNATIVES THAT ARE PROTECTIVE OF HUMAN

HEALTH AND THE ENVIRONMENT AND COMPLY WITH ARARS, THE US EPA HAS DETERMINED THAT AERATION OF THE VOLATILE ORGANIC CONTAMINATED SOILS SATISFIES THE STATUTORY PREFERENCE FOR REMEDIES THAT EMPLOY TREATMENT OF THE PRINCIPAL THREATS AND PROVIDE THE BEST POSSIBLE BALANCE IN TERMS OF LONG-TERM EFFECTIVENESS AND PERMANENCE, REDUCTION IN TOXICITY, MOBILITY OR VOLUME ACHIEVED THROUGH TREATMENT, SHORT-TERM EFFECTIVENESS, IMPLEMENTABILITY AND COST WHILE CONSIDERING STATE AND COMMUNITY ACCEPTANCE.

ALTHOUGH THE CONTINGENCY ALTERNATIVE PROVIDES AN EQUALLY GOOD BALANCE OF THE ABOVE-REFERENCED CRITERIA, IT DOES NOT SATISFY THE STATUTORY PREFERENCE FOR REMEDIES THAT EMPLOY TREATMENT OF THE PRINCIPAL SITE THREATS. DUE TO THE SMALL AMOUNT OF MATERIAL AND THE LOW LEVELS OF CONTAMINATION PRESENT AT THE SITE, THIS ALTERNATIVE CAN BE IMPLEMENTED AND COMPLETED MORE QUICKLY AND WITH LESS DIFFICULTY THAN OTHER TECHNOLOGIES AND WILL ALSO BE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT.

#DSC

DOCUMENTATION OF SIGNIFICANT CHANGES

THE PREFERRED ALTERNATIVE, ALTERNATIVE 5, AND THE CONTINGENCY ALTERNATIVE, ALTERNATIVE 4, WERE ORIGINALLY PROPOSED TO HAVE O&M SAMPLING CONDUCTED ONCE A YEAR. BECAUSE KARST SYSTEMS CAN CHANGE RAPIDLY, O&M SAMPLING WILL BE CONDUCTED QUARTERLY. THIS INCREASE IN SAMPLING CREATED AN INCREASE IN THE O&M COSTS AND CAPITAL COSTS FOR THESE ALTERNATIVES.

#RS

RESPONSIVENESS SUMMARY

THIS RESPONSIVENESS SUMMARY IS ORGANIZED INTO THE FOLLOWING SECTIONS AND ATTACHMENTS:

I. RESPONSIVENESS SUMMARY OVERVIEW. THIS SECTION OUTLINES THE PURPOSES OF THE PUBLIC COMMENT PERIOD AND THE RESPONSIVENESS SUMMARY. IT ALSO REFERENCES THE APPENDED BACKGROUND INFORMATION LEADING UP TO THE PUBLIC COMMENT PERIOD.

II. BACKGROUND ON COMMUNITY INVOLVEMENT AND CONCERNS. THIS SECTION PROVIDES A BRIEF HISTORY OF COMMUNITY CONCERNS AND INTERESTS IDENTIFIED AS PART OF THE COMMUNITY RELATIONS PLAN AND DURING THE RI/FS.

III. SUMMARY OF MAJOR QUESTIONS AND COMMENTS RECEIVED DURING THE PUBLIC MEETING AND EPA RESPONSES TO THESE COMMENTS. THIS SECTION SUMMARIZES THE ORAL COMMENTS RECEIVED BY EPA AT THE AUGUST 2, 1990 PUBLIC MEETING, AND PROVIDES EPA'S RESPONSES TO THESE COMMENTS.

IV. WRITTEN COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND EPA'S RESPONSES TO THESE COMMENTS. THIS SECTION CONTAINS THE THREE LETTERS RECEIVED BY EPA DURING THE PUBLIC COMMENT PERIOD, AS WELL AS EPA'S WRITTEN RESPONSES TO THE LETTERS.

V. WRITTEN COMMENTS RECEIVED FROM COMMONWEALTH AND EPA'S RESPONSE. THIS SECTION CONTAINS THE COMMONWEALTH OF KENTUCKY'S COMMENTS REGARDING THE DRAFT PROPOSED PLAN WHICH WERE RECEIVED DURING THE PUBLIC COMMENT PERIOD. THE COMMONWEALTH WAS GIVEN THE OPPORTUNITY TO REVIEW THE PROPOSED PLAN PRIOR TO ITS RELEASE TO THE PUBLIC. THE CONCERNS SET FORTH IN THE LETTER WERE ADDRESSED IN THE FINAL VERSION OF THE PROPOSED PLAN. IN THE COMMONWEALTH'S COMMENTS, IT IS STATED THAT KRS 224.877 IS AN ARAR. EPA'S RESPONSE IS ALSO PROVIDED IN THIS SECTION.

ATTACHMENT A: ATTACHMENT A CONTAINS THE PROPOSED PLAN WHICH WAS DISTRIBUTED TO THE PUBLIC DURING THE PUBLIC MEETING HELD ON AUGUST 2, 1990 AND MAILED TO THE INFORMATION REPOSITORY AND PERSONS INCLUDED ON THE MAILING LIST.

ATTACHMENT B: ATTACHMENT B INCLUDES THE SIGN IN SHEETS FROM THE PUBLIC MEETING HELD ON AUGUST 2, 1990 AT THE HOWE VALLEY ELEMENTARY SCHOOL, HARDINSBURG ROAD, CECILIA, KENTUCKY.

ATTACHMENT C: ATTACHMENT C INCLUDES THE NAME, ADDRESS AND PHONE NUMBER OF THE INFORMATION REPOSITORY DESIGNATED FOR THE HOWE VALLEY LANDFILL SITE.

ATTACHMENT D: ATTACHMENT D INCLUDES THE OFFICIAL TRANSCRIPT OF THE PUBLIC HEARING ON THE PROPOSED PLAN FOR THE CLEANUP OF THE HOWE VALLEY LANDFILL NATIONAL PRIORITIES LIST SITE LOCATED IN HOWE VALLEY, KENTUCKY.

I. RESPONSIVENESS SUMMARY OVERVIEW

THE US ENVIRONMENTAL PROTECTION AGENCY (EPA) HELD A PUBLIC COMMENT PERIOD FROM JULY 27 THROUGH AUGUST 27, 1990 FOR INTERESTED PARTIES TO COMMENT ON THE REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) RESULTS AND THE PROPOSED PLAN FOR THE HOWE VALLEY LANDFILL IN HOWE VALLEY, KENTUCKY.

THE PROPOSED PLAN, INCLUDED IN ATTACHMENT A OF THIS DOCUMENT, PROVIDES A SUMMARY OF THE SITE'S BACKGROUND INFORMATION LEADING UP TO THE PUBLIC COMMENT PERIOD. SPECIFICALLY, THE PROPOSED PLAN INCLUDES THE FOLLOWING SECTIONS: INTRODUCTION, SITE BACKGROUND, SCOPE AND ROLE OF RESPONSE ACTION, SUMMARY OF SITE RISKS, SUMMARY OF ALTERNATIVES, EVALUATION AND ANALYSIS OF ALTERNATIVES, THE COMMUNITY'S ROLE IN THE SELECTION PROCESS, LIST OF CONTACTS, GLOSSARY OF EVALUATION CRITERIA, AND GLOSSARY OF TERMS.

EPA HELD A PUBLIC MEETING AT 7:30 PM ON AUGUST 2, 1990 AT THE HOWE VALLEY ELEMENTARY SCHOOL IN CECILIA, KENTUCKY TO OUTLINE THE RI/FS AND DESCRIBE EPA'S PROPOSED REMEDIAL ALTERNATIVES FOR CONTAMINANTS FOUND IN THE ON-SITE SOILS. ALL COMMENTS RECEIVED BY EPA DURING THE PUBLIC COMMENT PERIOD WILL BE CONSIDERED IN THE FINAL SELECTION OF A REMEDIAL ALTERNATIVE FOR THE AREAS OF CONTAMINATION AT THE HOWE VALLEY LANDFILL SITE.

THE RESPONSIVENESS SUMMARY, REQUIRED BY THE SUPERFUND LAW, PROVIDES A SUMMARY OF THE COMMONWEALTH OF KENTUCKY'S AND CITIZENS' COMMENTS AND CONCERNS IDENTIFIED AND RECEIVED DURING THE PUBLIC COMMENT PERIOD, AND EPA'S RESPONSES TO THOSE COMMENTS AND CONCERNS.

II. BACKGROUND ON COMMUNITY INVOLVEMENT AND CONCERNS

THE HOWE VALLEY LANDFILL WAS USED DURING THE YEARS 1967 TO 1976 AS AN INDUSTRIAL WASTE LANDFILL. THE TYPES OF WASTES DEPOSITED INTO THE LANDFILL INCLUDED BY-PRODUCTS FROM SILICONE MANUFACTURING PROCESSES, METAL PLATING SLUDGES, VARIOUS INSULATION AND SEALING COMPOUNDS, AND HOUSEHOLD REFUSE FROM LOCAL RESIDENTS.

COMPLAINTS FROM LOCAL RESIDENTS ABOUT WASTE DISPOSAL ACTIVITIES AT THE LANDFILL PROMPTED THE INITIAL SITE INVESTIGATIONS CONDUCTED BY THE STATE OF KENTUCKY DIVISION OF WASTE MANAGEMENT. THE FIRST COMPLAINT WAS FILED IN 1974 AND INVOLVED THE UNPERMITTED DUMPING OF ACIDIC LIQUID WASTES INTO THE LANDFILL. IN 1979, A COMPLAINT WAS FILED REGARDING ODORS FROM AN ON-SITE POND. AN ADDITIONAL CONCERN WAS CREATED WHEN SEVERAL HORSES GRAZING NEAR THE LANDFILL DIED FROM LIVER ABNORMALITIES.

THE LEVEL OF PUBLIC CONCERN REGARDING THE HOWE VALLEY LANDFILL HAS BEEN LOW, EXCEPT FOR RESIDENTS LIVING NEAR THE LANDFILL. WHILE THE LANDFILL WAS IN OPERATION, RESIDENTS WITNESSED THE DISPOSAL OF LIQUID WASTES FROM A TANKER TRUCK DIRECTLY INTO THE ON-SITE POND. THIS INCIDENT INCREASED THE CONCERNS OF THOSE LIVING NEAR THE LANDFILL.

SEVERAL PUBLIC CONCERNS WERE EXPRESSED REGARDING THE REMOVAL AND REMEDIAL INVESTIGATION

ACTIVITIES. A GENERAL COMPLAINT CONCERNING THE LANDFILL WAS THE INCREASED TRUCK TRAFFIC. HEALTH CONCERNS INVOLVED THE EFFECTS OF CONSUMING CONTAMINATED WATER AND DIRECT CONTACT WITH CONTAMINATED SOIL. LOCAL RESIDENTS DEPENDENT ON PRIVATE WELLS FOR THEIR POTABLE WATER WERE CONCERNED WITH THE QUALITY OF THE GROUNDWATER. LOCAL OFFICIALS WERE CONCERNED WITH THE POTENTIAL MIGRATION OF CONTAMINANTS INTO NEARBY STREAMS AND RIVERS, WHICH COULD AFFECT THE PUBLIC WATER SUPPLY. OTHER CONCERNS WERE EXPRESSED REGARDING SURFACE WATER CONTAMINATION, SUCH AS PONDS AND STREAMS, AND THE EFFECTS ON ANIMALS CONSUMING CONTAMINATED WATER. DIRECT EXPOSURE TO CONTAMINATED SOILS WAS ALSO A CONCERN FOR CITIZENS WHO USED THE LANDFILL PROPERTY FOR RECREATIONAL PURPOSES, WHICH INCLUDE HUNTING, HIKING, AND MOTORCYCLES.

EPA CONDUCTED AN INFORMATION BRIEFING AND PUBLIC INFORMATION SESSION FOR THE LOCAL COMMUNITY IN JUNE 1988, PRIOR TO INITIATION OF THE REMEDIAL INVESTIGATION. THE MAJOR QUESTIONS AND CONCERNS RAISED BY THE COMMUNITY AND THE EPA RESPONSES ARE SUMMARIZED BELOW:

1. ONE CITIZEN ASKED HOW MANY DRUMS ARE LOCATED AT THE SITE.

EPA RESPONSE: THE CONTRACTOR ESTIMATES APPROXIMATELY 5,500 DRUMS. SOME DRUMS HAVE BEEN PLACED INSIDE LARGER DRUMS. MOST DRUMS ARE IN GOOD SHAPE; THEY ARE NOT CORRODED.

2. ONE CITIZEN ASKED WHAT TYPES OF MATERIALS ARE BURIED ON THE SITE.

EPA RESPONSE: CAULKING WASTES AND PLATING SLUDGES ARE THE PREDOMINANT WASTES KNOWN TO DATE.

3. ONE CITIZEN ASKED HOW THE DRUMS, ONCE UNCOVERED, WILL BE TRANSPORTED FROM THE SITE.

EPA RESPONSE: SAMPLES ARE SENT OFF-SITE FOR THE TREATABILITY STUDY; HOWEVER, THE WASTES MAY BE INITIALLY TREATED ON-SITE USING SUCH TREATMENTS AS CHEMICAL SOLIDIFICATION AND CHEMICAL FIXATION. IF SHIPPED OFF-SITE, THE CONTRACTOR WILL MOST LIKELY USE A TANKER.

4. ONE CITIZEN WAS CONCERNED WITH THE MIGRATION OF CONTAMINATION DURING DRUM REMOVAL.

EPA RESPONSE: AS FAR AS OFFICIALS KNOW, NO WASTE HAS FLOWED OFF THE SITE IN ANY DIRECTION AND THE EXCAVATION PROCESS IS NOT EXPECTED TO CAUSE CONTAMINATION TO SPREAD BEYOND THE DEFINED CONTAMINATION ZONE. THE CONTAMINATION ZONE IS THE SITE AREA DESIGNATED FOR ACCOMMODATING CONTAMINATED MATERIALS. A BERM WAS CONSTRUCTED AND AN IMPERMEABLE LINER WAS INSTALLED TO REDUCE SURFACE RUNOFF. THE CONTAMINATION ZONE IS USED FOR THE STORAGE OF DRUMMED WASTES AND CONTAMINATED SOIL.

5. ONE CITIZEN ASKED IF SILICONE IS A TOXIC OR HAZARDOUS WASTE.

EPA RESPONSE: AS FAR AS EPA KNOWS, SILICONE IS NOT A TOXIC OR HAZARDOUS WASTE. THE PROPERTIES OF SILICONE ARE UNDER EXAMINATION.

6. ONE CITIZEN ASKED WHERE NON-HAZARDOUS WASTES FROM THE SITE WILL BE DISPOSED.

EPA RESPONSE: EPA WILL DISCUSS WITH THE STATE OF KENTUCKY WHERE NON-HAZARDOUS WASTES WILL BE DISPOSED.

ADDITIONAL COMMUNITY RELATIONS ACTIVITIES CONDUCTED BY EPA AT THE HOWE VALLEY LANDFILL TO DATE INCLUDE THE FOLLOWING:

- EPA CONDUCTED COMMUNITY INTERVIEWS WITH THE LOCAL COMMUNITY IN APRIL 1988
- EPA PREPARED AND DISTRIBUTED A FACT SHEET CONTAINING INFORMATION ON THE HOWE VALLEY LANDFILL IN MAY 1988
- EPA ESTABLISHED AN INFORMATION REPOSITORY AT THE HARDIN COUNTY PUBLIC LIBRARY IN JUNE 1988
- EPA ISSUED A PRESS RELEASE ANNOUNCING THE SCHEDULED PUBLIC INFORMATION SESSION HELD ON JUNE 28, 1988
- EPA CONDUCTED A BRIEFING AND PUBLIC INFORMATION SESSION IN JUNE 1988 FOR BOTH LOCAL OFFICIALS AND PRIVATE CITIZENS AT THE HOWE VALLEY ELEMENTARY SCHOOL BEFORE REMEDIAL INVESTIGATION ACTIVITIES BEGAN
- EPA ISSUED A PRESS RELEASE, IN JULY 1988, REGARDING THE GROUNDWATER STUDY CONDUCTED AT THE HOWE VALLEY LANDFILL
- EPA ISSUED A PRESS RELEASE, IN JULY 1988, ANNOUNCING THE REMOVAL OF DRUMS FROM THE HOWE VALLEY LANDFILL
- EPA ISSUED A PRESS RELEASE, IN AUGUST 1988, ANNOUNCING THE REMOVAL OF METAL PLATING WASTES FROM THE HOWE VALLEY LANDFILL
- EPA PREPARED A COMMUNITY RELATIONS PLAN IN SEPTEMBER 1988
- EPA RELEASED THE ADMINISTRATIVE RECORD FOR PUBLIC REVIEW IN JULY 1990
- EPA PREPARED AND DISTRIBUTED A PROPOSED PLAN FACT SHEET IN JULY 1990
- A 30-DAY PUBLIC COMMENT PERIOD WAS HELD FOR THE COMMUNITY TO EXPRESS ANY COMMENTS OR QUESTIONS ON THE PROPOSED PLAN (JULY 27 - AUGUST 27, 1990)
- EPA CONDUCTED A PUBLIC MEETING ON AUGUST 2, 1990 AT THE HOWE VALLEY ELEMENTARY SCHOOL TO PRESENT THE SELECTED ALTERNATIVE AND EPA'S PROPOSED PLAN FOR REMEDIATION OF THE HOWE VALLEY LANDFILL

III. SUMMARY OF MAJOR QUESTIONS AND COMMENTS RECEIVED DURING THE PUBLIC MEETING AND EPA RESPONSES TO THESE COMMENTS.

COMMENTS RAISED DURING THE HOWE VALLEY LANDFILL PUBLIC MEETING AND PUBLIC COMMENT PERIOD ON THE PROPOSED PLAN ARE SUMMARIZED BELOW. THE PUBLIC MEETING WAS HELD ON AUGUST 2, 1990. THE COMMENTS ARE CATEGORIZED BY TOPIC.

A. SELECTED REMEDIAL ALTERNATIVE

THE FOLLOWING COMMENTS OR QUESTIONS WERE RAISED REGARDING THE SELECTED REMEDIAL ALTERNATIVE:

1. ONE LOCAL OFFICIAL ASKED WHY ALTERNATIVE 5, THE SELECTED REMEDIAL ALTERNATIVE, WAS SELECTED OVER THE OTHER FIVE ALTERNATIVES AND WHETHER ALTERNATIVE 5 INCLUDES MONITORING OF AIR, SOIL AND WATER. THE LOCAL OFFICIAL CONCURRED THAT ALTERNATIVE 5 WAS THE BEST CHOICE FOR REMEDIATION OF

THE SITE.

EPA RESPONSE: EPA SELECTED ALTERNATIVE 5 BECAUSE IT COMPLIES WITH ALL OF THE NINE EVALUATION CRITERIA USED BY EPA IN CHOOSING A CLEANUP METHOD, AND WAS THE MOST COST EFFECTIVE. IN ADDITION, THE MAJORITY OF THE SOIL WILL REMAIN ON-SITE AND NOT FILL OTHER LANDFILLS WITH MORE HAZARDOUS WASTES. ALTERNATIVE 5 WILL ALSO INCLUDE MONITORING OF SOIL, AIR AND WATER.

2. IN REGARD TO ALTERNATIVE 5, ONE CITIZEN ASKED HOW OFTEN THE SITE WOULD BE MONITORED, WHO WOULD CONDUCT THE MONITORING, WHETHER EPA WOULD COLLECT SPLIT SAMPLES, AND IF ANY BIO-MONITORING WOULD BE CONDUCTED.

EPA RESPONSE: MONITORING OF THE SITE WILL BE CONDUCTED QUARTERLY BY THE PRPS UNLESS THEY DECLINE TO CONDUCT THE REMEDIAL ACTION. IF THE PRPS DECLINE, EPA WILL CONDUCT THE MONITORING. IF THE PRPS CONDUCT THE MONITORING, EPA WILL COLLECT AND ANALYZE SPLIT SAMPLES. THERE ARE NO KNOWN BIOLOGICAL RISKS ASSOCIATED WITH THE SITE; THEREFORE, NO BIO-MONITORING WILL BE CONDUCTED.

B. GENERAL COMMENTS/QUESTIONS REGARDING THE SITE AND ASSOCIATED HEALTH RISKS

1. ONE CITIZEN ASKED WHY THE BURIED DRUMS, PRIOR TO REMOVAL, WERE DISTRIBUTED ONLY ONE DRUM DEEP AND UPRIGHT IN THE OUTER AREAS OF THE SITE, WHILE THE CENTRAL AREA CONTAINED LARGE STACKS OF DRUMS, WITH THE MAJORITY OF THE DRUMS BURIED SIDEWAYS, ALLOWING MORE LEAKAGE OF WASTES.

EPA RESPONSE: THE CENTRAL AREA OF THE SITE HAS A DEEPER SOIL COVER DOWN TO BEDROCK, WHILE THE OUTLYING AREAS HAVE ONLY A FEW FEET OF SOIL COVER TO BEDROCK. FOR THESE REASONS, MORE DRUMS COULD BE BURIED DEEPER IN THE CENTRAL AREA THAN IN THE OUTER AREAS.

2. ONE CITIZEN WANTED TO KNOW THE CONCENTRATION OF CYANIDE IN SOIL REMAINING ON THE SITE. THIS CITIZEN DID NOT FEEL THAT THE HEALTH RISKS ASSOCIATED WITH THE SITE WERE OF MUCH CONCERN.

EPA RESPONSE: THE LEVELS OF CYANIDE IN BOTH THE SOIL AND GROUNDWATER ON THE SITE ARE BELOW 1 PART PER MILLION (PPM), SIGNIFICANTLY LESS THAN LEVELS THAT WOULD RESULT IN A HUMAN HEALTH OR ENVIRONMENTAL RISK.

3. ONE CITIZEN WAS CONCERNED ABOUT THE LEVELS OF CONTAMINANTS IN SPRINGS SURROUNDING BOUTWELL SPRING. THIS CITIZEN STATED THAT HE OWNED A FARM NEAR BOUTWELL SPRING WHICH CONTAINED SEVERAL SPRINGS THAT WERE NEVER MONITORED.

EPA RESPONSE: ALTHOUGH PREVIOUS SAMPLING OF BOUTWELL SPRING INDICATED THAT LOW LEVELS OF CONTAMINATION WERE PRESENT, THE CONCENTRATIONS WERE WELL BELOW THE MAXIMUM CONCENTRATIONS SET BY EPA DRINKING WATER STANDARDS. BECAUSE THE LOCATION OF THE CITIZEN'S SPRINGS APPEARS TO BE BETWEEN THE SITE AND BOUTWELL SPRING, EPA WILL CONSIDER MONITORING THESE SPRINGS.

4. ONE CITIZEN EMPLOYED WITH THE LOCAL FIRE DEPARTMENT WAS CONCERNED WITH THE HEALTH RISKS TO FIRE DEPARTMENT PERSONNEL SHOULD A FIRE OCCUR AT THE SITE.

EPA RESPONSE: FROM THE SITE DATA AVAILABLE AND LEVELS OF CONTAMINATION FOUND IN ON-SITE SOILS, THERE IS NO RISK TO FIRE DEPARTMENT PERSONNEL GOING ONTO THE SITE PROPERTY SHOULD A FIRE OCCUR, ASSUMING STANDARD FIRE FIGHTING PRACTICES ARE FOLLOWED (E.G., APPROACHING THE FIRE FROM THE UPWIND DIRECTION).

5. ONE RESIDENT LIVING APPROXIMATELY 1-2 MILES NORTHEAST OF THE SITE WAS CONCERNED ABOUT FUTURE QUALITY OF GROUNDWATER CURRENTLY USED FOR DRINKING WATER PURPOSES, THE POTENTIAL HEALTH RISKS FROM CONSUMING FOOD GROWN IN LOCAL SOILS, AND THE LIKELIHOOD OF INCREASE CANCER FOR THOSE LIVING NEAR THE SITE.

EPA RESPONSE: THE DRINKING WATER SOURCE FOR THE HOWE VALLEY RESIDENTS IS LOCATED UPGRADIENT FROM THE SITE, THEREFORE THE POTENTIAL FOR CONTAMINATION OF THIS WATER SOURCE IS EXTREMELY LOW. CONTAMINANTS WERE ONLY DETECTED IN GROUNDWATER SOUTH OF THE SITE, AT LEVELS WELL BELOW MAXIMUM LEVELS ALLOWED BY EPA DRINKING WATER STANDARDS. THE EXTENT OF SOIL CONTAMINATION IS WITHIN THE SITE BOUNDARIES. THE GREATEST RISK OF SOIL CONTAMINATION IS THROUGH DIRECT EXPOSURE TO HUMANS. SOILS LOCATED OFF THE SITE AND USED FOR AGRICULTURAL PURPOSES SHOULD POSE NO RISK TO HUMAN HEALTH. THE TOTAL INDIVIDUAL LIFETIME AVERAGE CARCINOGENIC RISK ASSOCIATED WITH THE SITE IS LOWER THAN APPLICABLE FEDERAL STANDARDS. THE ESTIMATED RISK OF AN INDIVIDUAL DEVELOPING CANCER FROM ON-SITE EXPOSURE IS ONE IN ONE BILLION.

IV. WRITTEN COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND EPA'S RESPONSES TO THESE COMMENTS

COMMENTS RAISED DURING THE HOWE VALLEY LANDFILL PUBLIC COMMENT PERIOD ARE SUMMARIZED BELOW. THE PUBLIC COMMENT PERIOD WAS HELD FROM JULY 27 TO AUGUST 27, 1990.

1. ONE CITIZEN PROPOSED AN ADDITIONAL METHOD FOR SITE REMEDIATION. THE CITIZEN SUGGESTED APPLYING LIME TO THE SOIL AT THE RATE OF 6 TO 10 TONS PER ACRE AT A DEPTH OF 1 TO 3 FEET. AFTER APPROXIMATELY 2 WEEKS, THE SOIL CAN BE PREPARED FOR RESEEDING USING FERTILIZER AND A MIXTURE OF CLOVER AND GRASS SEEDS.

EPA RESPONSE: THE LIME APPLICATION METHOD SUGGESTED IS USED IN THE SEWAGE TREATMENT PROCESS TO STABILIZE SLUDGES AND RAISE THE PH. THIS PROCESS REDUCES ODOR AND HELPS IN THE DESTRUCTION OF PATHOGENS. GIVEN THE NATURE OF THE WASTES AT THE SITE SUCH A PROCESS WOULD NOT BE EFFECTIVE. THE SPECIFIC METHODOLOGY FOR REVEGETATING THE SITE HAS NOT BEEN CHOSEN. THE SOIL TYPE AND CLIMATE OF THE AREA WILL BE CONSIDERED BEFORE SELECTING A SUITABLE GROUND COVER; HOWEVER, A MIXTURE OF GRASS AND CLOVER WILL BE CONSIDERED AS A GROUND COVER ALTERNATIVE.

2. ONE CITIZEN WAS NOT INFORMED OF THE PUBLIC MEETING HELD ON AUGUST 2, 1990, AT THE HOWE VALLEY ELEMENTARY SCHOOL. THE CITIZEN STATED THAT IF SHE HAD KNOWN ABOUT THE MEETING, SHE WOULD HAVE ATTENDED BECAUSE OF HER CONCERNS REGARDING THE HEALTH AND QUALITY OF LIFE OF NEARBY RESIDENTS.

EPA RESPONSE: LOCAL RESIDENTS WERE INFORMED OF THE PUBLIC MEETING THROUGH MAILINGS AND A PUBLIC NOTICE IN THE LOCAL NEWSPAPER, THE NEWS-ENTERPRISE. EPA REGRETS THAT THIS CITIZEN WAS NOT NOTIFIED. RESIDENTS NOTIFIED THROUGH THE MAIL WERE ON A MAILING LIST DEVELOPED FROM A LIST OF PREVIOUS MEETINGS ATTENDEES AND FROM INDIVIDUALS INTERVIEWED IN 1988. THIS CITIZEN WILL BE ADDED TO THE MAILING LIST TO RECEIVE FUTURE INFORMATION AND NOTICES.

3. ONE POTENTIALLY RESPONSIBLE PARTY (PRP) EXPRESSED THEIR SUPPORT OF EPA'S PROPOSED PLAN FOR THE HOWE VALLEY LANDFILL SITE.

EPA RESPONSE: THE PRP'S OPINION REGARDING THE PROPOSED PLAN AND SELECTED REMEDIES IS APPRECIATED.

V. WRITTEN COMMENTS RECEIVED FROM THE COMMONWEALTH AND EPA'S RESPONSE

COMMENTS RAISED BY THE COMMONWEALTH REGARDING THE DRAFT PROPOSED PLAN ARE PRESENTED IN THE FOLLOWING LETTER. IN COMPLIANCE WITH THE NATIONAL CONTINGENCY PLAN (NCP), AS REVISED MARCH 8, 1990, THE COMMONWEALTH WAS GIVEN THE OPPORTUNITY TO REVIEW THE PLAN BEFORE IT WAS RELEASED TO THE PUBLIC. THE FINAL VERSION OF THE PROPOSED PLAN ADDRESSED THE COMMONWEALTH'S CONCERNS.

IN THE LETTER, THE COMMONWEALTH CONTENTS THAT KRS 224.877 IS AN ARAR. EPA'S RESPONSE FOLLOWS THE COMMONWEALTH'S LETTER.

EPA RESPONSE CERCLA AND THE NATIONAL CONTINGENCY PLAN PRESCRIBE THAT REMEDIAL ACTIONS MUST ATTAIN REQUIREMENTS UNDER STATE ENVIRONMENTAL LAWS WHICH (I) SPECIFICALLY ADDRESS A HAZARDOUS SUBSTANCE, POLLUTANT, CONTAMINANT, REMEDIAL ACTION, LOCATION OR OTHER CIRCUMSTANCE FOUND AT A CERCLA SITE OR WHICH ARE DETERMINED TO BE RELEVANT AND APPROPRIATE, (II) ARE PROMULGATED, (III) ARE MORE STRINGENT THAN FEDERAL REQUIREMENTS, AND (IV) ARE TIMELY NOTIFIED TO THE PRESIDENT OR EPA ("ARARS"). KRS 224.877, AS AMENDED, IS NOT AN ARAR. THE SUBSTANTIVE PROVISIONS OF KRS 224.877 WHICH COULD ARGUABLY BE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS ARE CONTAINED IN SECTIONS 5 AND 10 THEREOF. AS DESCRIBED BELOW, NEITHER SECTION MEETS THE ELIGIBILITY CRITERIA FOR ARARS PROVIDED IN CERCLA OR IN THE NATIONAL CONTINGENCY PLAN.

SECTION 5 OF THE KENTUCKY STATUTE STATES THAT PERSONS HAVING POSSESSION OR CONTROL OVER A HAZARDOUS SUBSTANCE, POLLUTANT, OR CONTAMINANT BEING RELEASED OR WHO CAUSED THE RELEASE MUST TAKE "ACTIONS NECESSARY TO RESTORE THE ENVIRONMENT TO THE EXTENT PRACTICABLE AND MINIMIZE THE HARMFUL EFFECTS FROM ANY RELEASE INTO THE AIR, LANDS OR WATERS OR THE COMMONWEALTH." SUCH RESTORATION AND MINIMIZATION MERELY CONSTITUTE A GENERAL GOAL OR LEGISLATIVE INTENT ABOUT A DESIRED OUTCOME OR CONDITION RATHER THAN A SPECIFIC REQUIREMENT.

MOREOVER, SAID PROVISION IS NOT A BINDING REQUIREMENT AS IT ONLY APPLIES IN THE EVENT A PARTICULAR REMEDIAL ACTION DOES NOT MEET THE CRITERIA SET FORTH IN SECTION 10 OF THE STATUTE. SUCH A RELATIONSHIP BETWEEN SECTION 5 AND SECTION 10 IS CONFIRMED IN PARAGRAPH 15 OF THE ATTACHED LETTER WHICH STATES THAT THE COMMONWEALTH MAY "CONSIDER CLEANUP TO AN ALTERNATIVE LEVEL, BASED UPON SEVERAL HUMAN HEALTH AND ENVIRONMENTAL CRITERIA." AS KRS 224.877(5) IS A GENERAL GOAL WHICH DOES NOT SET OUT A SPECIFIC, ENFORCEABLE CLEANUP STANDARD AND WHICH IS NOT A BINDING REQUIREMENT, IT IS NOT A CLEANUP ARAR.

SECTION 10 OF KRS 224.877 STATES THAT REMEDIAL ACTIONS "SHALL PROTECT HUMAN HEALTH, SAFETY AND THE ENVIRONMENT" CONSIDERING CERTAIN FACTORS OUTLINED THEREIN AS APPROPRIATE. SECTION 10 DOES NOT CONSTITUTE AN ARAR EITHER BECAUSE THE PROTECTION OBLIGATION IS NOT MORE STRINGENT THAN FEDERAL REQUIREMENTS WHICH ARE RELEVANT TO REMEDIAL ACTIONS. FOR EXAMPLE, SECTION 121(D) OF CERCLA PROVIDES THAT REMEDIAL ACTIONS SHALL ATTAIN A DEGREE OF CLEANUP WHICH, AT A MINIMUM, ASSURES PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT. SECTION 121 OF CERCLA, IN ADDITION TO A MULTITUDE OF OTHER FEDERAL REQUIREMENTS GOVERNING REMEDIAL ACTIONS, IS EQUIVALENT TO OR MORE STRINGENT THAN THE MANDATE CONTAINED IN KRS 224.877(10).

IN SUMMARY, KRS 224.877 DOES NOT CONTAIN ANY SPECIFIC, ENFORCEABLE REQUIREMENTS THAT ARE MORE STRINGENT THAN PROVIDED BY FEDERAL LAW AND THUS IS NOT A STATE ARAR. NONETHELESS, THE US ENVIRONMENTAL PROTECTION AGENCY HAS COMPLIED WITH THE REQUIREMENTS OF KRS 224.877. ACCORDING TO SECTION 10 OF KRS 224.877, "THE REMEDIAL ACTION SHALL PROTECT HUMAN HEALTH, SAFETY, AND THE ENVIRONMENT CONSIDERING THE FOLLOWING FACTORS AS APPROPRIATE:

- (A) THE CHARACTERISTICS OF THE SUBSTANCE, POLLUTANT, OR CONTAMINANT, INCLUDING ITS TOXICITY, PERSISTENCE, ENVIRONMENTAL FATE AND TRANSPORT DYNAMICS, BIOACCUMULATION, BIOMAGNIFICATION, AND POTENTIAL FOR SYNERGISTIC INTERACTION AND WITH SPECIFIC REFERENCE TO THE ENVIRONMENT INTO WHICH THE SUBSTANCE, POLLUTANT, OR CONTAMINANT HAS BEEN RELEASED;
- (B) THE HYDROGEOLOGIC CHARACTERISTICS OF THE FACILITY AND THE SURROUNDING AREA;
- (C) THE PROXIMITY, QUALITY, AND CURRENT AND FUTURE USES OF SURFACE WATER AND GROUNDWATER;
- (D) THE POTENTIAL EFFECTS OF RESIDUAL CONTAMINATION OF POTENTIALLY IMPACTED SURFACE WATER AND GROUNDWATER;

(E) THE CHRONIC AND ACUTE HEALTH EFFECTS AND ENVIRONMENTAL CONSEQUENCES TO TERRESTRIAL AND AQUATIC LIFE OF EXPOSURE TO THE HAZARDOUS SUBSTANCE, POLLUTANT OR CONTAMINANT THROUGH DIRECT AND INDIRECT PATHWAYS;

(F) AN EXPOSURE ASSESSMENT; AND

(G) ALL OTHER AVAILABLE INFORMATION."

IF A PROPOSED REMEDIAL ACTION IS PROTECTIVE OF HUMAN HEALTH, SAFETY AND THE ENVIRONMENT TAKING THE ABOVE FACTORS INTO CONSIDERATION, THEN THE REMEDIAL ACTION IS IN COMPLIANCE WITH THE KENTUCKY STATUTE. THE REMEDY FOR THE HOWE VALLEY SITE PROPOSED BY EPA MET THE REQUIREMENTS OF KRS 224.877(10) THROUGH THE PERFORMANCE OF A REMEDIAL INVESTIGATION (RI), A FEASIBILITY STUDY (FS) AND A BASELINE RISK ASSESSMENT.

ACCORDING TO THE NATIONAL CONTINGENCY PLAN (NCP), AS REVISED MARCH 8, 1990, AN RI/FS SHALL BE UNDERTAKEN AT ALL NATIONAL PRIORITIES LIST (NPL) SUPERFUND SITES TO DETERMINE THE NATURE AND EXTENT OF THE THREAT PRESENTED BY THE RELEASE AND TO EVALUATE PROPOSED REMEDIES. SPECIFICALLY, THE RI IS PERFORMED TO COLLECT DATA NECESSARY TO ADEQUATELY CHARACTERIZE A SITE FOR THE PURPOSE OF DEVELOPING AND EVALUATING EFFECTIVE REMEDIAL ALTERNATIVES. CHARACTERIZATION ACTIVITIES INCLUDE:

- IDENTIFICATION OF IMPORTANT SURFACE FEATURES, SOILS, GEOLOGY, HYDROGEOLOGY, METEOROLOGY AND ECOLOGY;
- ASSESSMENT OF THE AIR, SURFACE WATERS AND GROUNDWATER;
- ASSESSMENT OF WASTES (INCLUDING QUANTITIES, STATE, CONCENTRATION, TOXICITY, PROPENSITY TO BIOACCUMULATE, PERSISTENCE, AND MOBILITY),
- IDENTIFICATION OF CONTAMINATION SOURCES;
- IDENTIFICATION OF EXPOSURE PATHWAYS THROUGH ENVIRONMENTAL MEDIA;
- IDENTIFICATION OF ACTUAL AND POTENTIAL HUMAN OR ENVIRONMENTAL EXPOSURE ROUTES (I.E., INHALATION AND INGESTION) ALONG WITH THEIR MAGNITUDE, FREQUENCY AND DURATION; AND,
- ASSESSMENT OF OTHER FACTORS THAT PERTAIN TO THE SITE OR SUPPORT THE ANALYSIS OF POTENTIAL REMEDIAL ACTION ALTERNATIVES.

AS THE STATE OF KENTUCKY IS AWARE, AN RI WAS CONDUCTED, IN ACCORDANCE WITH THE NCP, FOR THE HOWE VALLEY SITE. THE RI ACTIVITIES INCLUDED, BUT WERE NOT LIMITED TO, A CHARACTERIZATION OF WASTES BURIED ON-SITE, REMOVAL OF THESE WASTES, PRE- AND POST-REMOVAL ENVIRONMENTAL SAMPLING, A SOIL AERATION PILOT PROJECT AND A HYDROGEOLOGICAL CHARACTERIZATION OF THE HOWE VALLEY AREA.

DATA COLLECTED DURING THE RI WAS USED IN A BASELINE RISK ASSESSMENT. ACCORDING TO THE NCP, A BASELINE RISK ASSESSMENT IS CONDUCTED TO CHARACTERIZE THE CURRENT AND POTENTIAL THREATS TO HUMAN HEALTH AND THE ENVIRONMENT THAT MAY BE POSED BY CONTAMINANTS MIGRATING TO GROUNDWATER, RELEASING TO AIR, LEACHING THROUGH SOILS, AND BIOACCUMULATING IN THE FOOD CHAIN. FOR THE HOWE VALLEY SITE, THE RESULTS OF THE RI AND THE BASELINE RISK ASSESSMENT INDICATED THAT VERY LOW LEVELS OF RESIDUAL CONTAMINATION, SPECIFICALLY CHROMIUM AND TETRACHLOROETHENE, REMAIN IN THE ON-SITE SOILS AND POSE A POTENTIAL RISK TO HUMAN HEALTH AND THE ENVIRONMENT. PRIMARY ROUTES OF EXPOSURE TO HUMANS WOULD BE THROUGH THE INGESTION OF SOILS AND/OR GROUNDWATER ASSOCIATED WITH THE SITE.

IN ADDITION TO THE RI, AN FS WAS CONDUCTED FOR THE SITE. THIS IS REQUIRED BY THE NCP TO ENSURE THAT APPROPRIATE REMEDIAL ALTERNATIVES WERE DEVELOPED AND EVALUATED USING EPA'S NINE CRITERIA ANALYSIS. EACH ALTERNATIVE WAS ASSESSED TO DETERMINE WHETHER IT WOULD ADEQUATELY PROTECT HUMAN HEALTH AND THE ENVIRONMENT, IN BOTH THE SHORT- AND LONG-TERM, FROM UNACCEPTABLE RISKS POSED BY HAZARDOUS SUBSTANCES, POLLUTANTS, OR CONTAMINANTS PRESENT AT THE SITE. DURING THE HOWE VALLEY FS, SIX ALTERNATIVES WERE SELECTED AND EVALUATED. THESE SIX WERE CHOSEN BASED UPON THEIR APPLICABILITY AT THE SITE AND EFFECTIVENESS FOR REDUCING THE RISKS ASSOCIATED WITH THE SITE. OF THE SIX, ONE ALTERNATIVE, SOIL AERATION COMBINED WITH REMOVAL, WAS SELECTED AS THE FINAL REMEDY. THIS PARTICULAR ALTERNATIVE, UPON THE SUCCESS OF THE TREATABILITY STUDY, WILL MEET THE REQUIREMENTS OF THE NINE CRITERIA AND REDUCE THE SITE RISKS AT A MUCH LOWER COST THAN ANY OF THE OTHER ALTERNATIVES. ADDITIONALLY, THE CONTINGENCY REMEDY, REMOVAL OF CONTAMINATED SOIL, SHOULD IT BE IMPLEMENTED, WILL ALSO MEET ALL REQUIREMENTS AND REDUCE SITE RISKS.

THE RI DESCRIBES THE CHARACTERIZATION OF WASTES BURIED ON-SITE, INCLUDING THE CHARACTERISTICS SET FORTH IN KRS 224.877(10)(A). ADDITIONALLY, THE HYDROGEOLOGICAL ASSESSMENT FOR THE SITE, AS REQUIRED BY KRS 224.877(10)(B), WAS ACCOMPLISHED DURING RI ACTIVITIES. THE HYDROGEOLOGIC CHARACTERISTICS OF THE HOWE VALLEY AREA WERE DETERMINED THROUGH FOUR SEPARATE DYE TRACE STUDIES. THREE OF THE TRACES, CONDUCTED AT THE SITE, INDICATED THAT GROUNDWATER TRAVELS SOUTHEAST FROM THE SITE AND SURFACES 1.8 MILES AWAY AT BOUTWELL SPRING. THE ADDITIONAL TRACE WAS CONDUCTED BY THE US GEOLOGICAL SURVEY TO FIND AN ALTERNATE WATER SOURCE FOR THE HOWE VALLEY AREA. THIS STUDY INDICATED THE PRESENCE OF A GROUNDWATER DIVIDE NORTH OF THE SITE, BETWEEN THE SITE AND PIRTLE SPRING. THIS PARTICULAR SPRING SERVES AS THE DRINKING WATER SOURCE FOR THE HOWE VALLEY AREA. THE IMPLICATION IS THAT GROUNDWATER LEAVING THE SITE FLOWS ON THE OPPOSITE SIDE OF THE DIVIDE FROM PIRTLE SPRING; THUS, A NATURAL BARRIER EXISTS AGAINST POSSIBLY CONTAMINATED GROUNDWATER REACHING THE WATER SUPPLY. ALONG WITH THE DYE TRACES, THE RI ACTIVITIES ALSO INCLUDED THE EXAMINATION OF THE PROXIMITY, QUALITY, AND CURRENT AND FUTURE USES OF SURFACE WATER AND GROUNDWATER, AS DESCRIBED IN KRS 224.877(10)(C). THE RESULTS OF THESE EXAMINATIONS ARE DISCUSSED IN GREATER DETAIL IN THE RI REPORT.

THE POTENTIAL EFFECTS OF RESIDUAL CONTAMINATION, CHRONIC AND ACUTE HEALTH EFFECTS, ENVIRONMENTAL CONSEQUENCES AND THE EXPOSURE ASSESSMENT, ALSO REQUIRED BY KRS 224.877(10), WERE DETERMINED DURING THE BASELINE RISK ASSESSMENT. AS STATED EARLIER, THE SITE POSES A VERY LOW RISK TO INDIVIDUALS OR ANIMALS THAT INGEST ON-SITE SOILS OR GROUNDWATER. FURTHERMORE, THE REMEDIES, BOTH THE PRIMARY AND CONTINGENCY, PROPOSED IN THE ROD WILL LOWER THE RISK ASSOCIATED WITH THE SITE TO LEVELS ACCEPTABLE TO EPA AND IN COMPLIANCE WITH THE NCP. THE POTENTIAL EFFECTS OF RESIDUAL CONTAMINANTS ON IMPACTED SURFACE AND GROUNDWATER WAS A PRIMARY FACTOR IN THE DEVELOPMENT OF SOIL ACTION LEVELS (SALS). THE SALS CALCULATED FOR THE SITE TAKE INTO ACCOUNT THE POTENTIAL FOR RESIDUAL CONTAMINANTS TO LEACH FROM THE SOIL INTO THE GROUNDWATER. THE FINAL CONCENTRATIONS FOR SALS, AS STATED IN THE ROD, WILL BE PROTECTIVE OF BOTH SURFACE AND GROUNDWATER.

ALL OTHER AVAILABLE INFORMATION WAS INCORPORATED IN THE RI/FS REPORTS. COPIES OF THESE REPORTS WERE PRESENTED TO THE COMMONWEALTH FOR THEIR REVIEW. AN ADDITIONAL COPY IS CONTAINED IN THE HOWE VALLEY ADMINISTRATIVE RECORD.

SEVERAL PUBLIC CONCERNS WERE EXPRESSED REGARDING THE REMOVAL AND REMEDIAL INVESTIGATION ACTIVITIES. A GENERAL COMPLAINT CONCERNING THE LANDFILL WAS THE INCREASED TRUCK TRAFFIC. HEALTH CONCERNS INVOLVED THE EFFECTS OF CONSUMING CONTAMINATED WATER-AND DIRECT CONTACT WITH CONTAMINATED SOIL. LOCAL RESIDENTS DEPENDENT ON PRIVATE WELLS FOR THEIR POTABLE WATER WERE CONCERNED WITH THE QUALITY OF THE GROUNDWATER. LOCAL OFFICIALS WERE CONCERNED WITH THE POTENTIAL MIGRATION OF CONTAMINANTS INTO NEARBY STREAMS AND RIVERS, WHICH COULD AFFECT THE PUBLIC WATER SUPPLY. OTHER CONCERNS WERE EXPRESSED REGARDING SURFACE WATER CONTAMINATION, SUCH AS PONDS AND STREAMS, AND THE EFFECTS ON ANIMALS CONSUMING CONTAMINATED WATER. DIRECT EXPOSURE TO CONTAMINATED SOILS WAS ALSO A CONCERN FOR CITIZENS WHO USED THE LANDFILL PROPERTY FOR RECREATIONAL PURPOSES, WHICH INCLUDE HUNTING, HIKING, AND MOTORCYCLES.

EPA CONDUCTED AN INFORMATION BRIEFING AND PUBLIC INFORMATION SESSION FOR THE LOCAL COMMUNITY IN JUNE 1988, PRIOR TO INITIATION OF THE REMEDIAL INVESTIGATION. THE MAJOR QUESTIONS AND CONCERNS RAISED BY THE COMMUNITY AND THE EPA RESPONSES ARE SUMMARIZED BELOW:

1. ONE CITIZEN ASKED HOW MANY DRUMS ARE LOCATED AT THE SITE.

EPA RESPONSE: THE CONTRACTOR ESTIMATES APPROXIMATELY 5,500 DRUMS. SOME DRUMS HAVE BEEN PLACED INSIDE LARGER DRUMS. MOST DRUMS ARE IN GOOD SHAPE; THEY ARE NOT CORRODED.

2. ONE CITIZEN ASKED WHAT TYPES OF MATERIALS ARE BURIED ON THE SITE.

EPA RESPONSE: CAULKING WASTES AND PLATING SLUDGES ARE THE PREDOMINANT WASTES KNOWN TO DATE.

3. ONE CITIZEN ASKED HOW THE DRUMS, ONCE UNCOVERED, WILL BE TRANSPORTED FROM THE SITE.

EPA RESPONSE: SAMPLES ARE SENT OFF-SITE FOR THE TREATABILITY STUDY; HOWEVER, THE WASTES MAY BE INITIALLY TREATED ON-SITE USING SUCH TREATMENTS AS CHEMICAL SOLIDIFICATION AND CHEMICAL FIXATION. IF SHIPPED OFF-SITE, THE CONTRACTOR WILL MOST LIKELY USE A TANKER.

4. ONE CITIZEN WAS CONCERNED WITH THE MIGRATION OF CONTAMINATION DURING DRUM REMOVAL.

EPA RESPONSE: AS FAR AS OFFICIALS KNOW, NO WASTE HAS FLOWED OFF THE SITE IN ANY DIRECTION AND THE EXCAVATION PROCESS IS NOT EXPECTED TO CAUSE CONTAMINATION TO SPREAD BEYOND THE DEFINED CONTAMINATION ZONE. THE CONTAMINATION ZONE IS THE SITE AREA DESIGNATED FOR ACCOMMODATING CONTAMINATED MATERIALS. A BERM WAS CONSTRUCTED AND AN IMPERMEABLE LINER WAS INSTALLED TO REDUCE SURFACE RUNOFF. THE CONTAMINATION ZONE IS USED FOR THE STORAGE OF DRUMMED WASTES AND CONTAMINATED SOIL.

5. ONE CITIZEN ASKED IF SILICONE IS A TOXIC OR HAZARDOUS WASTE.

EPA RESPONSE: AS FAR AS EPA KNOWS, SILICONE IS NOT A TOXIC OR HAZARDOUS WASTE. THE PROPERTIES OF SILICONE ARE UNDER EXAMINATION.

6. ONE CITIZEN ASKED WHERE NON-HAZARDOUS WASTES FROM THE SITE WILL BE DISPOSED.

EPA RESPONSE: EPA WILL DISCUSS WITH THE STATE OF KENTUCKY WHERE NON-HAZARDOUS WASTES WILL BE DISPOSED.

ADDITIONAL COMMUNITY RELATIONS ACTIVITIES CONDUCTED BY EPA AT THE HOWE VALLEY LANDFILL TO DATE INCLUDE THE FOLLOWING:

- EPA CONDUCTED COMMUNITY INTERVIEWS WITH THE LOCAL COMMUNITY IN APRIL 1988
- EPA PREPARED AND DISTRIBUTED A FACT SHEET CONTAINING INFORMATION ON THE HOWE VALLEY LANDFILL IN MAY 1988
- EPA ESTABLISHED AN INFORMATION REPOSITORY AT THE HARDIN COUNTY PUBLIC LIBRARY IN JUNE 1988
- EPA ISSUED A PRESS RELEASE ANNOUNCING THE SCHEDULED PUBLIC INFORMATION SESSION HELD ON JUNE 28, 1988

- EPA CONDUCTED A BRIEFING AND PUBLIC INFORMATION SESSION IN JUNE 1988 FOR BOTH LOCAL OFFICIALS AND PRIVATE CITIZENS AT THE HOWE VALLEY ELEMENTARY SCHOOL BEFORE REMEDIAL INVESTIGATION ACTIVITIES BEGAN
- EPA ISSUED A PRESS RELEASE, IN JULY 1988, REGARDING THE GROUNDWATER STUDY CONDUCTED AT THE HOWE VALLEY LANDFILL
- EPA ISSUED A PRESS RELEASE, IN JULY 1988, ANNOUNCING THE REMOVAL OF DRUMS FROM THE HOWE VALLEY LANDFILL
- EPA ISSUED A PRESS RELEASE, IN AUGUST 1988, ANNOUNCING THE REMOVAL OF METAL PLATING WASTES FROM THE HOWE VALLEY LANDFILL
- EPA PREPARED A COMMUNITY RELATIONS PLAN IN SEPTEMBER 1988
- EPA RELEASED THE ADMINISTRATIVE RECORD FOR PUBLIC REVIEW IN JULY 1990
- EPA PREPARED AND DISTRIBUTED A PROPOSED PLAN FACT SHEET IN JULY 1990
- A 30-DAY PUBLIC COMMENT PERIOD WAS HELD FOR THE COMMUNITY TO EXPRESS ANY COMMENTS OR QUESTIONS ON THE PROPOSED PLAN (JULY 27 - AUGUST 27, 1990)
- EPA CONDUCTED A PUBLIC MEETING ON AUGUST 2, 1990 AT THE HOWE VALLEY ELEMENTARY SCHOOL TO PRESENT THE SELECTED ALTERNATIVE AND EPA'S PROPOSED PLAN FOR REMEDIATION OF THE HOWE VALLEY LANDFILL

III. SUMMARY OF MAJOR QUESTIONS AND COMMENTS RECEIVED DURING THE PUBLIC MEETING AND EPA RESPONSES TO THESE COMMENTS.

COMMENTS RAISED DURING THE HOWE VALLEY LANDFILL PUBLIC MEETING AND PUBLIC COMMENT PERIOD ON THE PROPOSED PLAN ARE SUMMARIZED BELOW. THE PUBLIC MEETING WAS HELD ON AUGUST 2, 1990. THE COMMENTS ARE CATEGORIZED BY TOPIC.

A. SELECTED REMEDIAL ALTERNATIVE

THE FOLLOWING COMMENTS OR QUESTIONS WERE RAISED REGARDING THE SELECTED REMEDIAL ALTERNATIVE:

1. ONE LOCAL OFFICIAL ASKED WHY ALTERNATIVE 5, THE SELECTED REMEDIAL ALTERNATIVE, WAS SELECTED OVER THE OTHER FIVE ALTERNATIVES AND WHETHER ALTERNATIVE 5 INCLUDES MONITORING OF AIR, SOIL AND WATER. THE LOCAL OFFICIAL CONCURRED THAT ALTERNATIVE 5 WAS THE BEST CHOICE FOR REMEDIATION OF THE SITE.

EPA RESPONSE: EPA SELECTED ALTERNATIVE 5 BECAUSE IT COMPLIES WITH ALL OF THE NINE EVALUATION CRITERIA USED BY EPA IN CHOOSING A CLEANUP METHOD, AND WAS THE MOST COST EFFECTIVE. IN ADDITION, THE MAJORITY OF THE SOIL WILL REMAIN ON-SITE AND NOT FILL OTHER LANDFILLS WITH MORE HAZARDOUS WASTES. ALTERNATIVE 5 WILL ALSO INCLUDE MONITORING OF SOIL, AIR AND WATER.

2. IN REGARD TO ALTERNATIVE 5, ONE CITIZEN ASKED HOW OFTEN THE SITE WOULD BE MONITORED, WHO WOULD CONDUCT THE MONITORING, WHETHER EPA WOULD COLLECT SPLIT SAMPLES, AND IF ANY BIO-MONITORING WOULD BE CONDUCTED.

EPA RESPONSE: MONITORING OF THE SITE WILL BE CONDUCTED QUARTERLY BY THE PRPS UNLESS THEY DECLINE TO CONDUCT THE REMEDIAL ACTION. IF THE PRPS DECLINE, EPA WILL CONDUCT THE MONITORING. IF THE PRPS CONDUCT THE MONITORING, EPA WILL COLLECT AND ANALYZE SPLIT SAMPLES. THERE ARE NO KNOWN

BIOLOGICAL RISKS ASSOCIATED WITH THE SITE; THEREFORE, NO BIO-MONITORING WILL BE CONDUCTED.

B. GENERAL COMMENTS/QUESTIONS REGARDING THE SITE AND ASSOCIATED HEALTH RISKS

1. ONE CITIZEN ASKED WHY THE BURIED DRUMS, PRIOR TO REMOVAL, WERE DISTRIBUTED ONLY ONE DRUM DEEP AND UPRIGHT IN THE OUTER AREAS OF THE SITE, WHILE THE CENTRAL AREA CONTAINED LARGE STACKS OF DRUMS, WITH THE MAJORITY OF THE DRUMS BURIED SIDEWAYS, ALLOWING MORE LEAKAGE OF WASTES.

EPA RESPONSE: THE CENTRAL AREA OF THE SITE HAS A DEEPER SOIL COVER DOWN TO BEDROCK, WHILE THE OUTLYING AREAS HAVE ONLY A FEW FEET OF SOIL COVER TO BEDROCK. FOR THESE REASONS, MORE DRUMS COULD BE BURIED DEEPER IN THE CENTRAL AREA THAN IN THE OUTER AREAS.

2. ONE CITIZEN WANTED TO KNOW THE CONCENTRATION OF CYANIDE IN SOIL REMAINING ON THE SITE. THIS CITIZEN DID NOT FEEL THAT THE HEALTH RISKS ASSOCIATED WITH THE SITE WERE OF MUCH CONCERN.

EPA RESPONSE: THE LEVELS OF CYANIDE IN BOTH THE SOIL AND GROUNDWATER ON THE SITE ARE BELOW 1 PART PER MILLION (PPM), SIGNIFICANTLY LESS THAN LEVELS THAT WOULD RESULT IN A HUMAN HEALTH OR ENVIRONMENTAL RISK.

3. ONE CITIZEN WAS CONCERNED ABOUT THE LEVELS OF CONTAMINANTS IN SPRINGS SURROUNDING BOUTWELL SPRING. THIS CITIZEN STATED THAT HE OWNED A FARM NEAR BOUTWELL SPRING WHICH CONTAINED SEVERAL SPRINGS THAT WERE NEVER MONITORED.

EPA RESPONSE: ALTHOUGH PREVIOUS SAMPLING OF BOUTWELL SPRING INDICATED THAT LOW LEVELS OF CONTAMINATION WERE PRESENT, THE CONCENTRATIONS WERE WELL BELOW THE MAXIMUM CONCENTRATIONS SET BY EPA DRINKING WATER STANDARDS. BECAUSE THE LOCATION OF THE CITIZEN'S SPRINGS APPEARS TO BE BETWEEN THE SITE AND BOUTWELL SPRING, EPA WILL CONSIDER MONITORING THESE SPRINGS.

4. ONE CITIZEN EMPLOYED WITH THE LOCAL FIRE DEPARTMENT WAS CONCERNED WITH THE HEALTH RISKS TO FIRE DEPARTMENT PERSONNEL SHOULD A FIRE OCCUR AT THE SITE.

EPA RESPONSE: FROM THE SITE DATA AVAILABLE AND LEVELS OF CONTAMINATION FOUND IN ON-SITE SOILS, THERE IS NO RISK TO FIRE DEPARTMENT PERSONNEL GOING ONTO THE SITE PROPERTY SHOULD A FIRE OCCUR, ASSUMING STANDARD FIRE FIGHTING PRACTICES ARE FOLLOWED (E.G., APPROACHING THE FIRE FROM THE UPWIND DIRECTION).

5. ONE RESIDENT LIVING APPROXIMATELY 1-2 MILES NORTHEAST OF THE SITE WAS CONCERNED ABOUT FUTURE QUALITY OF GROUNDWATER CURRENTLY USED FOR DRINKING WATER PURPOSES, THE POTENTIAL HEALTH RISKS FROM CONSUMING FOOD GROWN IN LOCAL SOILS, AND THE LIKELIHOOD OF INCREASE CANCER FOR THOSE LIVING NEAR THE SITE.

EPA RESPONSE: THE DRINKING WATER SOURCE FOR THE HOWE VALLEY RESIDENTS IS LOCATED UPGRADIENT FROM THE SITE, THEREFORE THE POTENTIAL FOR CONTAMINATION OF THIS WATER SOURCE IS EXTREMELY LOW. CONTAMINANTS WERE ONLY DETECTED IN GROUNDWATER SOUTH OF THE SITE, AT LEVELS WELL BELOW MAXIMUM LEVELS ALLOWED BY EPA DRINKING WATER STANDARDS. THE EXTENT OF SOIL CONTAMINATION IS WITHIN THE SITE BOUNDARIES. THE GREATEST RISK OF SOIL CONTAMINATION IS THROUGH DIRECT EXPOSURE TO HUMANS. SOILS LOCATED OFF THE SITE AND USED FOR AGRICULTURAL PURPOSES SHOULD POSE NO RISK TO HUMAN HEALTH. THE TOTAL INDIVIDUAL LIFETIME AVERAGE CARCINOGENIC RISK ASSOCIATED WITH THE SITE IS LOWER THAN APPLICABLE FEDERAL STANDARDS. THE ESTIMATED RISK OF INDIVIDUAL DEVELOPING CANCER FROM ON-SITE EXPOSURE IS ONE IN ONE BILLION.

IV. WRITTEN COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND EPA'S RESPONSES TO THESE COMMENTS

COMMENTS RAISED DURING THE ROWE VALLEY LANDFILL PUBLIC COMMENT PERIOD ARE SUMMARIZED BELOW. THE PUBLIC COMMENT PERIOD WAS HELD FROM JULY 27 TO AUGUST 27, 1990.

1. ONE CITIZEN PROPOSED AN ADDITIONAL METHOD FOR SITE REMEDIATION. THE CITIZEN SUGGESTED APPLYING LIME TO THE SOIL AT THE RATE OF 6 TO 10 TONS PER ACRE AT A DEPTH OF 1 TO 3 FEET. AFTER APPROXIMATELY 2 WEEKS, THE SOIL CAN BE PREPARED FOR RESEEDING USING FERTILIZER AND A MIXTURE OF CLOVER AND GRASS SEEDS.

EPA RESPONSE: THE LIME APPLICATION METHOD SUGGESTED IS USED IN THE SEWAGE TREATMENT PROCESS TO STABILIZE SLUDGES AND RAISE THE PH. THIS PROCESS REDUCES ODOR AND HELPS IN THE DESTRUCTION OF PATHOGENS. GIVEN THE NATURE OF THE WASTES AT THE SITE SUCH A PROCESS WOULD NOT BE EFFECTIVE. THE SPECIFIC METHODOLOGY FOR REVEGETATING THE SITE HAS NOT BEEN CHOSEN. THE SOIL TYPE AND CLIMATE OF THE AREA WILL BE CONSIDERED BEFORE .SELECTING A SUITABLE GROUNDCOVER; HOWEVER, A MIXTURE OF GRASS AND CLOVER WILL BE CONSIDERED AS A GROUNDCOVER ALTERNATIVE.

2. ONE CITIZEN WAS NOT INFORMED OF THE PUBLIC MEETING HELD ON AUGUST 2, 1990, AT THE HOWE VALLEY ELEMENTARY SCHOOL. THE CITIZEN STATED THAT IF SHE HAD KNOWN ABOUT THE MEETING, SHE WOULD HAVE ATTENDED BECAUSE OF HER CONCERNS REGARDING THE HEALTH AND QUALITY OF LIFE OF NEARBY RESIDENTS.

EPA RESPONSE: LOCAL RESIDENTS WERE INFORMED OF THE PUBLIC MEETING THROUGH MAILINGS AND A PUBLIC NOTICE IN THE LOCAL NEWSPAPER, THE NEWS-ENTERPRISE. EPA REGRETS THAT THIS CITIZEN WAS NOT NOTIFIED. RESIDENTS NOTIFIED THROUGH THE MAIL WERE ON A MAILING LIST DEVELOPED FROM A LIST OF PREVIOUS MEETINGS ATTENDEES AND FROM INDIVIDUALS INTERVIEWED IN 1988. THIS CITIZEN WILL BE ADDED TO THE MAILING LIST TO RECEIVE FUTURE INFORMATION AND NOTICES.

3. ONE POTENTIALLY RESPONSIBLE PARTY (PRP) EXPRESSED THEIR SUPPORT OF EPA'S PROPOSED PLAN FOR THE HOWE VALLEY LANDFILL SITE.

EPA RESPONSE: THE PRP'S OPINION REGARDING THE PROPOSED PLAN AND SELECTED REMEDIES IS APPRECIATED.

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TABLE 5
COPPER-CYANIDE SLUDGE ANALYSIS

CONTAMINANTS	CONCENTRATIONS	
	(MG/L)	
	SAMPLE 1	SAMPLE 2
INORGANICS		
SILVER	ND	ND
ARSENIC	ND	ND
BARIUM	0.37	0.43
CADMIUM	0.02	0.02
COBALT	ND	ND
CHROMIUM	ND	ND
COPPER	200	200
NICKEL	ND	ND
LEAD	0.12	0.05
ANTIMONY	ND	0.20
SELENIUM	ND	ND
ZINC	3.3	3.2

TABLE 6
OILY-WASTE TRENCH ANALYSIS

CONTAMINANTS	CONCENTRATION RANGES (MG/KG)
VOLATILE ORGANICS	
ACETONE	ND
BENZENE	ND
BROMODICHLOROMETHANE	ND
BROMOFORM	ND
2-BUTANONE	ND
CARBON DISULFIDE	ND
CARBON TETRACHLORIDE	ND
CHLOROBENZENE	ND
CHLOROBENZENE	ND
CHLOROETHANE	ND
CHLOROFORM	ND
CHLOROMETHANE	ND
1,1-DICHLOROETHANE	ND
1,2-DICHLOROETHANE	ND
1,1-DICHLOROETHENE	ND
1,2-DICHLOROETHENE (TOTAL)	ND
1,2-DICHLOROPROPANE	ND
CIS-1,3-DICHLOROPROPANE	ND
TRANS-1,3-DICHLOROPROPANE	ND
DIBROMOCHLOROETHANE	ND
ETHYLBENZENE	ND
HEXANONE	ND
4-METHYL-2-PENTANONE	ND
METHYLENE CHLORIDE	ND
STYRENE	ND
1,1,1-TRICHLOROETHANE	ND
1,1,2-TRICHLOROETHANE	ND
1,1,2,2-TETRACHLOROETHANE	ND
TETRACHLOROETHENE	ND
TRICHLOROETHENE	ND
TOLUENE	ND
VINYL ACETATE	ND
VINYL CHLORIDE	ND
TOTAL XYLENES	

ABOVE RESULTS ARE FOR BOTH COMPOSITE SAMPLES

TABLE 6 CONTINUED
OILY-WASTE TRENCH ANALYSIS

CONTAMINANTS	CONCENTRATIONS	
	(MG/KG)	
	SAMPLE 1	SAMPLE 2
INORGANICS		
SILVER	ND	ND
ALUMINUM	11,000	10,000
ARSENIC	5.4	5.7
BARIUM	57	45
BERYLLIUM	0.44	0.58
CALCIUM	1,500	1,500
CADMIUM	ND	ND
COBALT	ND	ND
CHROMIUM	11	13
COPPER	8.0	7.5
IRON	19,000	19,000
MERCURY	ND	ND
POTASSIUM	500	500
MAGNESIUM	600	720
MANGANESE	980	590
SODIUM	26	33
NICKEL	7.0	7.5
LEAD	15	17
ANTIMONY	ND	ND
SELENIUM	ND	ND
THALLIUM	ND	ND
VANADIUM	26	20
ZINC	42	34

SAMPLE WERE COMPRISED OF COMPOSITES COLLECTED AT FOUR DIFFERENT DEPTHS.

TABLE 8
INSULATION PILE COMPOSITE ANALYSIS

A TOTAL OF THREE COMPOSITE SAMPLES WERE TAKEN FROM TRENCHES CUT INTO THE INSULATION PILE. THE RANGE OF CONCENTRATIONS IS PRESENTED BELOW.

CONTAMINANTS	CONCENTRATION RANGES
	(MG/KG)
ETHYLBENZENE	ND - 7.0
1,1,1-TRICHLOROETHANE	ND - 3.0
TOTAL XYLENES	14 - 79
TRICHLOROFLOUROMETHANE	23(J) - 390(J)
ASBESTOS TYPES	ND
BIS (2-ETHYLHEXYL) PHTHALATE	1500 - 2400
PENTACHLOROPHENOL	ND - 3(J)
SILVER	0.5 - 1.0
ALUMINUM	200 - 270
BARIUM	8.8 - 15.9
CALCIUM	570 - 1500
CHROMIUM	4.0 - 5.0
COPPER	5.5 - 52.0
IRON	140 - 200
POTASSIUM	37 - 82
MAGNESIUM	91 - 240
MANGANESE	9 - 20
SODIUM	26 - 96
NICKEL	ND - 2.0
LEAD	15 - 22
VANADIUM	ND - 3.5
ZINC	32 - 120
NON - ASBESTO FIVERS (CELLULOSE)	25 PERCENT
NON - FIBEROUS MATERIAL	75 PERCENT

TABLE 9
BACKGROUND SOIL SAMPLE METALS ANALYSIS

CONTAMINANTS	CONCENTRATIONS (MG/KG)	
	BRW1	BRW2
INORGANICS		
SILVER	ND	0.5
ALUMINUM	13,000	15,000
ARSENIC	20	14
BARIUM	31	95
BERYLLIUM	0.66	0.79
CALCIUM	1,300	3,500
CADMIUM	ND	ND
COBALT	ND	ND
CHROMIUM	80	16
COPPER	9.5	14
IRON	89,000	42,000
MERCURY	ND	ND
POTASSIUM	420	580
MAGNESIUM	670	1,200
MANGANESE	270	370
SODIUM	24	40
NICKEL	17	18
LEAD	29	25
ANITMONY	ND	ND
SELENIUM	0.44	0.36
THALLIUM	ND	ND
VANADIUM	54	29
ZINC	62	63

TABLE 10
METALS ANALYSIS OF SOIL SAMPLES

AREA COMPOSITE ID	CONCENTRATIONS (MG/KG)		
	TOTAL CHROMIUM	TOTAL ZINC	COPPER
1A	1300	1300	N/A
2A	840	880	N/A
3A	19	31	N/A
4A	350	360	N/A
4B	1600	1700	N/A
5A	180	240	2400*
6A	11	26	N/A
6B	16	48	N/A
7A	18	49	N/A
8A	18	35	22**

TABLE 11
TCL ORGANIC AND INORGANIC CHEMICAL CONCENTRATIONS
FOR ON-SITE SURFACE WATERS

COMPOUND	FLOW INTO ON-SITE SINKHOLE (MG/L)
1,1,1-TRICHLOROETHANE	0.0044J
ALUMINUM	3.4
BARIUM	0.04
CALCIUM	32
IRON	4
COPPER	0.02
POTASSIUM	1.7
MAGNESIUM	2.6
MANGANESE	0.14
SODIUM	3.1
ZINC	0.06
CYANIDE	ND

* J COMPOUND DETECTED BUT BELOW QUATITATION LIMIT, QUANTIFICATION SUSPECT.

TABLE 12
TCL ORGANIC AND INORGANIC CHEMICAL CONCENTRATIONS
SEDIMENT SAMPLES
CONCENTRATIONS
(MG/KG)

CONTAMINANTS	SINKHOLE	BOUTWELL SPRING
PHENOL	ND	0.2 J
SILVER	ND	0.9
ALUMINUM	10000	12000
ARSENIC	5.7	0
BARIUM	50	260
CALCIUM	4200	6700
CADMIUM	ND	0.6
COBALT	10	51
CHROMIUM	46	85
COPPER	35	10
IRON	15000	93000
POTASSIUM	750	1200
MAGNESIUM	830	1200
MANGANESE	630	5000
SODIUM	57	120
NICKEL	9	47
LEAD	17	58
SELENIUM	1.3	ND
THALLIUM	ND	9
VANADIUM	16	36
ZINC	71	75
CYANIDE	0.6	0.9

* ONLY CHEMICALS DETECTED ARE LISTED IN TABLE.

** J COMPOUND DETECTED BUT BELOW QUANTIFICATION LIMIT, QUANTIFICATION SUSPECT

TABLE 14
SOIL TOTAL CONTAMINANT LIST ANALYSIS

CONTAMINANTS	SURFACE		BOTTOM	
	#OF HITS	RANGE (MG/KG)	# OF HITS	RANGE (MG/KG)
SILVER	0	ND	0	ND
ALUMINUM	4	11000-15000	4	12000-18000
ARSENIC	4	4-7.8	4	3.2-7.9
BARIUM	4	33-53	4	41-160
BERYLLIUM	3	ND-0.25	4	0.25-3.1
CALCIUM	4	1500-2900	4	1500-12000
CADIUM	0	ND	1	ND-1.8
COBALT	4	5.4-10	4	7.2-15
CHROMIUM	4	16-170	4	11-53
COPPER	4	5.4-16	4	7-18
IRON	4	15000-22000	4	12000-27000
MERCURY	0	ND	1	ND-0.26
POTASSIUM	4	160-1000	4	800-1900
MAGNESIUM	4	660-1000	4	820-1600
MANGANESE	4	230-620	4	53-870
SODIUM	4	68-130	4	80-120
NICKEL	4	8.1-14	4	13-59
LEAD	4	8.2-17	4	12-14
ANTIMONY	0	ND	0	ND
SELENIUM	0	ND	1	ND-2.4
THALLIUM	0	ND	1	ND-6.8
VANADIUM	4	15-21	4	4-25
ZINC	4	42-210	4	16-131
1,1,1-TCA	2	ND-0.015	1	ND-2.7
PCE	3	ND-6.0	1	ND-25
1,2-DCE	0	ND	1	ND-0.62
BUTYL BENZYL				
PHTHALATE	0	ND	1	ND-0.07 J
DIETHYL PHTHALATE	0	ND	1	ND-0.10 J
2-METHYLNAPHTHALENE	0	ND	1	ND-0.06 J
NAPHTHALENE	0	ND	1	ND-0.09 J
BIS (2 ETHYLHEXYL)				
PHTHALATE	1	ND-0.3 J	0	ND
TRICHLOROETHENE	0	ND	1	ND-0.69

1,1,1-TCA = 1,1,1-TRICHLOROETHANE

PCE - TETRACHLOROETHENE

1,2-DCE = 1,2-DICHLOROETHENE

TABLE 19
ESTIMATED EMISSION RATES AND ON-SITE AIR CONCENTRATIONS
DUE TO DUST GENERATION BY DIRT BIKES

CHEMICAL	ESTIMATED EMISSION RATE		
	SURFACE SOIL CONCENTRATIONS	PROBABLE AVERAGE RATE	POSSIBLE MAXIMUM RATE
	(MG/KG)	(MG/SEC)	(MG/SEC)
1,2-DICHLOROETHENE	1.0E-01	1.7E-05	1.0E-04
TETRACHLOROETHENE	6.2E-01	1.1E-04	6.3E-04
1,1,1-TRICHLOROETHANE	2.1E-01	3.6E-05	2.2E-04
CHROMIUM	5.1E+01	8.7E-03	5.2E-02
COPPER	2.1E+01	3.6E-03	2.2E-02
ZINC	8.3E+01	1.4E-02	8.6E-02
CYANIDE	8.7E-01	1.5E-04	8.9E-04

TABLE 19
ESTIMATED EMISSION RATES AND ON-SITE AIR CONCENTRATIONS
DUE TO DUST GENERATION BY DIRT BIKES

CHEMICAL	PROBABLE AVERAGE	POSSIBLE MAXIMUM
	(MG/M3)	(MG/M3)
1,2-DICHLOROETHENE	7.0E-11	4.2E-10
TETRACHLOROETHENE	1.4E-08	8.5E-08
1,1,1-TRICHLOROETHANE	1.5E-10	8.9E-10
CHROMIUM	1.2E-06	6.9E-06
COPPER	1.5E-08	9.2E-08
ZINC	5.8E-08	3.6E-07
CYANIDE	6.0E-10	3.7E-09

TABLE 23
SUMMARY OF SITE HEALTH RISKS

EXPOSURE ROUTE	LIFETIME CANCER RISKS	
	PAR	PMR
CURRENT SCENARIO		
SURFACE SOIL	1 X (10-9)	5 X (10-9) (1)
SURFACE WATER	NONE DETECTED	
DIRT BIKES	3 X (10-8)	7 X (10-7)

EXPOSURE ROUTE	HAZARD INDICES	
	PAR	PMR
CURRENT SCENARIO		
SURFACE SOIL	2 X (10-3)	7 X (10-3)
SURFACE WATER	2 X (10-4)	1 X (10-3)
DIRT BIKES	2 X (10-9)	4 X (10-8)

FUTURE SCENARIO		
SURFACE SOIL	7 X (10-9)	4 X (10-8) (2)
RESIDENTS GROUNDWATER	5 X (10-7)	1 X (10-6)

EXPOSURE ROUTE	HAZARD INDICES	
	PAR	PMR
FUTURE SCENARIO		
SURFACE SOIL	8 X (10-3)	3 X (10-2) (3)
RESIDENTS GROUNDWATER	1 X (10-2)	2 X (10-2)

* IF THE INDIVIDUAL RETURNS TO THE SAME LOCATION DAY AFTER DAY, YEAR AFTER YEAR, FOR A LIFETIME, THE POSSIBLE MAXIMUM RISK COULD BE:

- (1) LIFETIME CANCER RISKS OF 1 X (10-6) AT 8E DUE TO PCE
- (2) LIFETIME CANCER RISK OF 1 X (10-5) AT 8E DUE TO PCE
- (3) HAZARD INDEX OF 2 AT 7D DUE TO CR +6

TABLE 24
ALTERNATIVE 5
OFF-SITE REMOVAL AND ON-SITE AERATION

A. CAPITAL COSTS

ACTIVITY	PRESENT WORTH	TOTALS
MOBILIZATION EQUIPMENT/STAFF	\$5,000	
TEMP. FACILITIES	2,000	
SITE PREPARATION	3,000	
SITE REMEDIATION		
EXCAVATE/TREAT	148,000	
HAUL/DISPOSE (METALS)	25,000	
TOP SOIL/SPREADING	30,000	
VEGETATION	3,000	
MONITORING	50,000	
ENGINEERING/ADMINISTRATION	40,000	
		\$ 306,000

OPERATION & MAINTENANCE

A. GROUNDWATER MONITORING AT BOUTWELL SPRING (QUARTERLY FOR FIVE YEARS)

PERSONNEL 7 HOURS AT \$50/HOUR	\$350
LABORATORY 4 SAMPLES AT \$500 EACH	2,000
	2,350
	X 4 QUARTERS
ANNUAL TOTAL	\$9,400

B. RISK ASSESSMENT (AT END OF 5 YEAR PERIOD)

PERSONNEL 20 HOURS AT \$50/HOUR	\$1,000
LABORATORY 4 SAMPLES AT \$500 EACH	2,000
TOTAL	\$3,000

SUBTOTAL

REMOVAL/AERATION COST	\$306,000
OPERATIONS & MAINTENANCE	37,065
	343,065
CONTINGENCY (15 PERCENT)	51,460
TOTAL COSTS	\$394,525

TABLE 25
ALTERNATIVE 4
OFF-SITE REMOVAL

A. CAPITAL COSTS

ACTIVITY	PRESENT WORTH	TOTALS
MOBILIZATION EQUIPMENT/STAFF	\$5,000	
TEMP. FACILITIES	2,000	
SITE PREPARATION	3,000	
SITE REMEDIATION		
EXCAVATE	112,500	
HAUL/DISPOSE (METALS)	3,000,000	
FILL	55,000	
TOP SOIL/SPREADING	30,000	
VEGETATION	3,000	
MONITORING	50,000	
ENGINEERING/ADMINISTRATION	50,000	
		\$ 3,312,500

OPERATION & MAINTENANCE

A. GROUNDWATER MONITORING AT BOUTWELL SPRING (QUARTERLY FOR FIVE YEARS)

PERSONNEL 7 HOURS AT \$50/HOUR	\$350
LABORATORY 4 SAMPLES AT \$500 EACH	2,000
	2,350
	X 4 QUARTERS
ANNUAL TOTAL	\$ 9,400

B. RISK ASSESSMENT (AT END OF 5 YEAR PERIOD)

PERSONNEL 20 HOURS AT \$50/HOUR	\$ 1,000
LABORATORY 4 SAMPLES AT \$500 EACH	2,000
TOTAL	\$ 3,000

SUBTOTAL

REMOVAL/AERATION COST	\$ 3,312,500
OPERATIONS & MAINTENANCE	37,065
	3,349,565
CONTINGENCY (15 PERCENT)	502,435
TOTAL COSTS	\$ 3,852,000